Pit and Quarry

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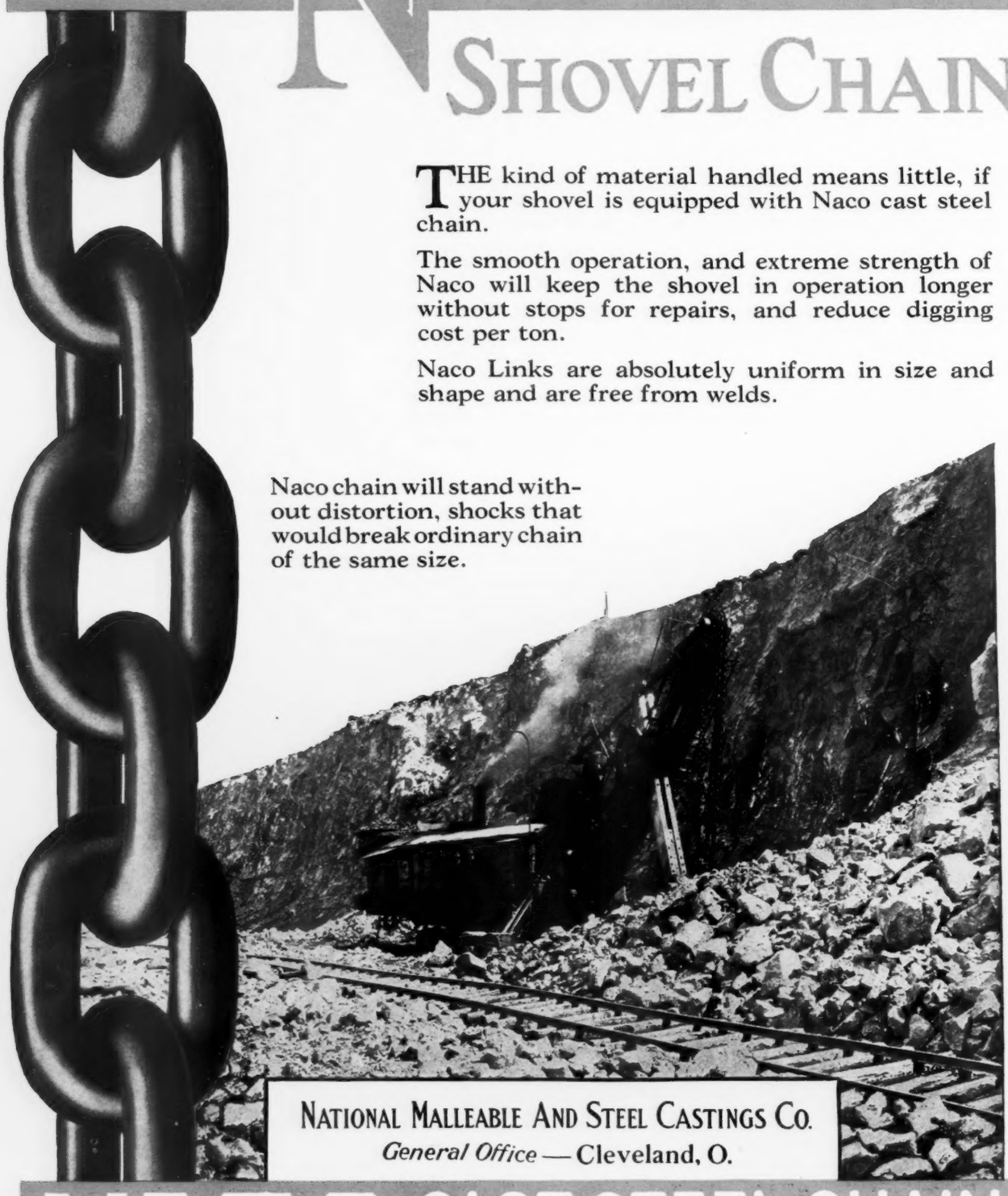

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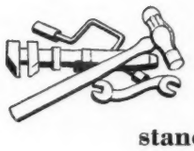

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Pit and Quarry

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Vol. XIX CHICAGO, MARCH 12, 1930 No. 12

CONTENTS

New Quarry and Improvements Have Modernized West's Pioneer Wet Process Plant 41

Delegates from Missouri Cement Mills Attend St. Louis Regional Safety Meeting . 49

Aerial Tramway Transports Raw Material Five Miles to Plant of Northwest Magnesite Company 51

Developing the Non-Metallic Industries of the West 58

Pioneer Sand and Gravel Company Operates Two Complete Plants at Steilacoom, Wash. 61

New Quarry Plant near Orifino, Idaho, Prepares Crushed and Pulverized Limestone 67

Gravel Ballast for Railroad Purposes 71

American Concrete Institute Discusses Numerous Practical and Technical Problems 72

Portland Cement Association Holds Regional Safety Meeting at La Salle, Ill. 74

Effect of Characteristics of Aggregate on the Quality of Concrete 75

Men of the Industry 83
Personal Mention 92
Financial News Corporate and Business ... 93
Legal Information for Operators 94
Traffic News and Comment 95
Insurance Problems Discussed 96
Review of Foreign Practice 97
Latest News Flashes 98
New Machinery and Supplies 101

Next Issue March 26, 1930

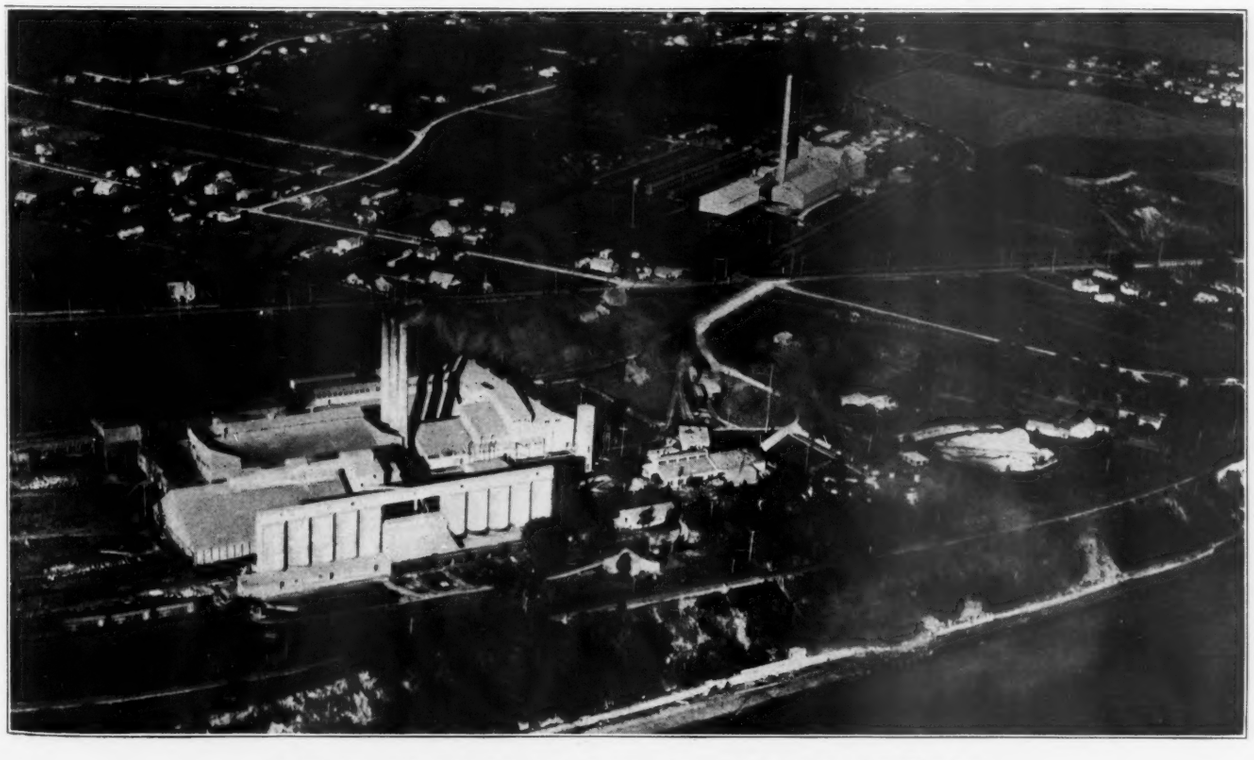
Pit and Quarry
With which is consolidated
CEMENT-MILL & QUARRY

Vol. XIX CHICAGO, MARCH 12, 1930 No. 12

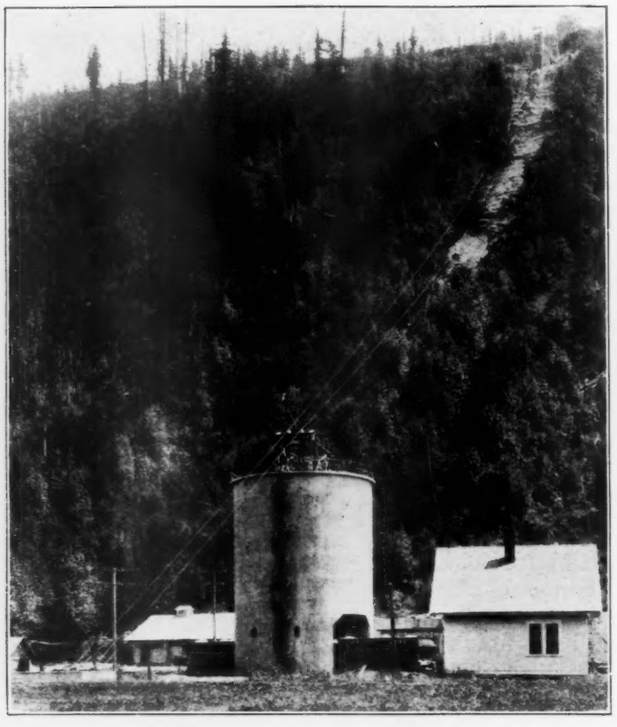
New Quarry and Improvements Have Modernized West's Pioneer Wet Process Cement Plant

By FRANCIS CHURCH LINCOLN
Professor of Mining, South Dakota State School of Mines, Rapid City, S. D.

THE cement mill of the Olympic Portland Cement Company at Bellingham, Whatcom County, Wash., was built in 1912 and began operating in May, 1913. While it was the fifth portland cement mill to be built in the state, it had the distinction of being the first wet process plant in the West. F. L. Smidth and Company of New York City designed the plant and supplied most of its machinery. Oil was used as fuel for burning, up to 1918, when pulverized coal equipment was installed. The mill originally had but two kilns with a capacity of 2,000 bbl. of cement a day, but in 1925 a third kiln was added, together with a Unidan mill for finish grinding, which increased the daily capacity to 3,000 bbl. The cost of the original plant was about $2,000,000 and the additional equipment entailed an expenditure of about $350,000. In 1926, the company purchased a limestone quarry at Limestone Junction, Wash., and two years later erected a new crushing plant and aerial tramway there. During 1929, the old limestone quarry at Balfour was abandoned in favor of the new quarry. In the same year, 8 new cement silos were constructed at the plant by the Casseday Engineering and Construction Company of Seattle, increasing the cement storage capacity from 100,000 bbl. to 150,000



Aerial view, Olympic Portland Cement Company's plant at Bellingham



Lower terminal of aerial tramway

bbl. For several years past, the Olympic Portland Cement Company has been experimenting with the production of "Velo"—a high early strength cement—and it is now producing it regularly in addition to ordinary portland cement under its "Olympic" brand.

Limestone Quarry

The new limestone quarry mentioned above is situated on a stub line of the Chicago, Milwaukee and St. Paul railroad about 30 mi. northeast of Bellingham. The quarry is "new" only in its relaton to the Olympic Portland Cement Company, having been worked for many years by the International Lime Company. The quarry facilities provided by the lime company were inadequate to handle the increased tonnage required for cement manufacture, so a new road, crushing plant, and aerial tramway were constructed. A switchback road from 20 to 30 ft. in width and 2 mi. in length with a rise of 1,000 ft. was constructed, from the railroad on the valley floor to the quarry site, by a Bucyrus 100B crawler-mounted electric shovel, equipped with a 3-cu. yd. dipper. This shovel, starting at the bottom of the hill, completed the road in 45 working days and on reaching the quarry, remained there to handle the loading of the limestone.

The quarry rock is a pure, hard, metamorphic limestone of fairly uniform composition, coarse of grain and light gray in color, with the following analysis:

Silica	1.32%
Ferric Oxide and Alumina	0.50%
Calcium Carbonate	97.58%
Magnesium Carbonate	0.36%
Alkalies by difference	0.24%
	100.00%

The limestone is exposed over an area about ½ mi. in length by ¼ mi. in width, and dips into the hill at an angle of about 70 deg.

Drilling and Blasting

The quarry face is about 75 ft. in height and 500 ft. in length and is being drilled with rock drills. When the face becomes higher and reaches

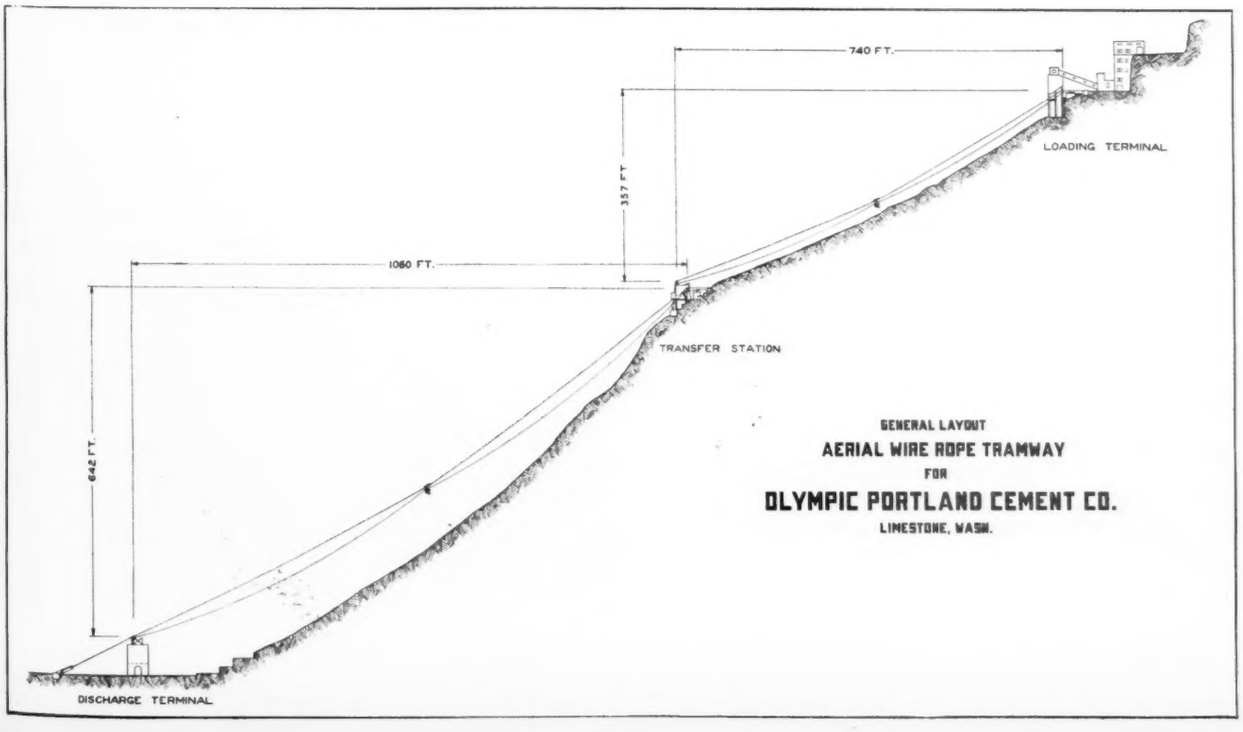
Tramway loading terminal (left), and crusher house at quarry

a safe distance from the crushing plant, well drills will be introduced. Eventually, the face will be about 280 ft. in height by 1,000 ft. in length. The quarry is now being worked in three 25-ft. benches which are broken from both vertical and horizontal holes. The vertical holes are drilled from 14 ft. to 20 ft. deep, spaced from 5 ft. to 7 ft. apart, and set from 10 ft. to 14 ft. back from the face. Hollow Swedish drill steel, 1¼-in. in diameter and in lengths of from 3 to 26 ft., is employed. The starting gage is 2 in. and the final gage on a 20-ft. hole is 1⅝ in. Two Chicago Pneumatic No. 5 sinkers are used in drilling. The horizontal holes, which determine the bench bottoms, are drilled in groups of three or four from a single set-up and run fanwise into the face, usually slightly depressed but sometimes slightly elevated. The advantages claimed for this method of drilling are that it takes less time for set-ups and that it necessitates less bench cleaning. The benches are made narrow so that blasting will throw most of the broken limestone down to the quarry floor, and the drillers, with ropes about them to protect them from falling, must clean spaces for drill set-ups on the steep quarry face, which makes the shifting of drilling operations difficult. Occasionally a second similar set of lifters is drilled about 18 in. above the first set, and sometimes even a third set is drilled 18 in. higher, but this is only when the bench is unusually high and heavy. A Chicago Pneumatic No. 6 and a Gardner-Denver drifter, both tripod mounted, are employed to drill the toe-holes. All holes are drilled dry. A sinker will drill 150 ft. of hole in a shift and a drifter 200 ft. Five No. 55 Denver Clipper drills are available for block-holing.

The compressed air to operate the quarry drills

Discharge station of aerial tramway

is supplied by an Ingersoll-Rand Imperial Type 10 two-stage air compressor. This compressor is driven by a 100-hp. 2,200-volt General Electric induction motor through a Lenix drive. It is located at the crusher house, and the power for it and for the motors which drive the various machines of the crushing plant is purchased from the Puget Sound Power and Light Company, a subsidiary of



J. C. Ristine (left), quarry foreman, and F. E. Ristine, quarry superintendent

Stone and Webster. The electric power is brought to the plant at 66,000 volts and stepped down by three transformers to the 2,200-volt and 440-volt currents used by the motors. The air compressor delivers its compressed air to a pipe line provided with two 3½-ft. by 9-ft. Ingersoll-Rand air receivers, one located at the crusher house and the other at the neighboring blacksmith shop. The blacksmith shop is of concrete construction and is equipped for drill sharpening and for the ordinary run of quarry repairs. It contains an Ingersoll-Rand oil forge and Type 50 drill sharpener, an Oxyweld portable acetylene generator and welding outfit, a company-made blacksmith's coal forge, shop drills, and the usual assortment of small tools.

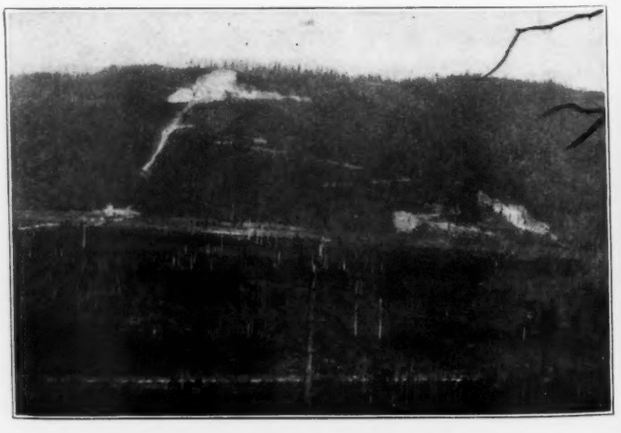
Trojan powder, in 1¼-in. by 8-in. sticks, is employed for all blasting, 40 and 60 per cent strengths being used according to conditions. Detonation is accomplished by Dupont Comet Special double-countered tape-covered fuse and No. 8 California blasting caps, or by electric caps. Holes are loaded with about 8 ft. of powder and drift holes are tamped by inserting two "plugs," or dummy cartridges, on top of the charge. Down holes are tamped by inserting from 2 to 3 ft. of loose tamping above the powder. Current from the electric power circuit is used to detonate the electric caps of the large shots, while the small shots and block-holes are fired by fuse. The powder consumption in the ordinary limestone varies from ½-lb. to ¾-lb. per cu. yd. The broken limestone is loaded by the Bucyrus shovel into 6-cu. yd. Western side-dump quarry cars, of which 18 are available but only six in present use. The loaded cars are hauled to the crusher house in three-car trains by two McCormick-Deering 8-ton gasoline locomotives. The quarry cars dump directly upon the primary crusher in the crusher house.

Crushing

The crushing plant was designed by F. L. Smidth and Company and has a capacity of 250 tons per hour. The crusher house is of reinforced concrete and steel construction, and was constructed by the company. The primary crusher is a 42-in. Allis-Chalmers Superior-McCully gyratory, driven by a 250-hp. General Electric motor installed in an adjoining room to protect it from dust. This motor is provided with a flexible coupling and drives through a 24-in. leather belt equipped with a Lenix belt tightener. The gyratory breaks the limestone into 5-in. fragments, which drop into a 50-ton surge bin. From this bin, a 2-ft. by 6-ft. Bodinson reciprocating-pan feeder, driven by a 7½-hp. Fairbanks-Morse motor, handles the material to a 7-ft. Symons cone crusher, driven by a 250-hp. General Electric motor, which is also installed in an adjoining room. The Symons cone crusher reduces the limestone to a maximum diameter of ⅝ in. From the cone crusher the material is raised to the loading bin of an aerial tramway by a Gutta Percha 30-in. belt conveyor, mounted on Stearns Rex carrier and return rolls, which slopes upward at 15 deg. on 145-ft. centers. This conveyor is driven by a 20-hp. General Electric motor with a speed of 855 r.p.m. through a De Laval worm reduction gear with a ratio of 32½ to 1.

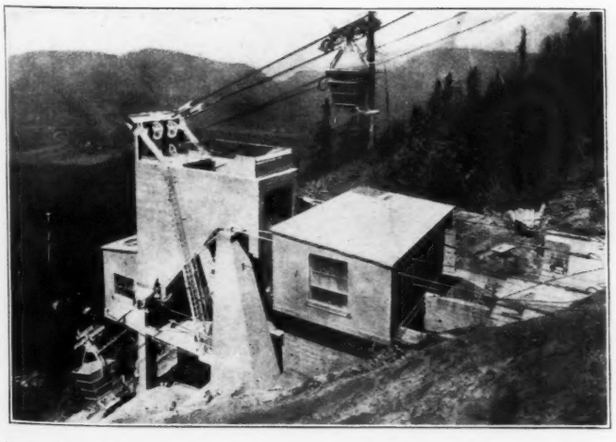
Aerial Tramway

The aerial tramway which lowers the crushed limestone from the quarry to the railroad is of an



Limestone quarry on hill in distance. Note zigzag road

unusual type, being built in two sections, arranged in tandem, in each of which two carriers operate in balance. It was designed, manufactured, and installed by A. Leschen and Sons Rope Company of St. Louis. The problem which the designers had to solve was to find the best method of transporting 150 tons of crushed limestone per hour down a steep, irregular hillside for some 2,000 ft.—the horizontal distance being approximately 1,800 ft. and the vertical 1,000 ft. A surface gravity-incline and the continuous aerial system were given serious consideration before a decision was reached. The objections to the surface incline were that it would have required extensive grading, much of which would have been in rock; that it would have been necessary to construct a long trestle from the hillside to the top of the railroad bin over the tracks; and that the control arrangement would have been very expensive since the speed would have had to be kept slow. The objections to the ordinary form of continuous aerial tramway were that it would require intermediate supports which would keep the speed slow, making it necessary to employ a large number of carriers; that it would require an extensive structure at its upper end in order to make the necessary transition from sloping cables to horizontal rails; and that the upkeep would be high because of the many carriers and heavy stresses. An ordinary reversible aerial tramway with a single span, such as is used extensively in the Alleghenies for handling coal, could not be used in this case since its efficient operation requires the absence of intermediate supports while on this hillside a decided change in profile occurs at about one-third the distance down, precluding the use of a single, unsupported span. An examination of construction, operating, and maintenance costs of the various systems, however, indicated that two single-span reversible tramways arranged in tandem with the upper one feeding the lower would prove more economical than a surface incline or a continuous aerial system—and this design was finally adopted.

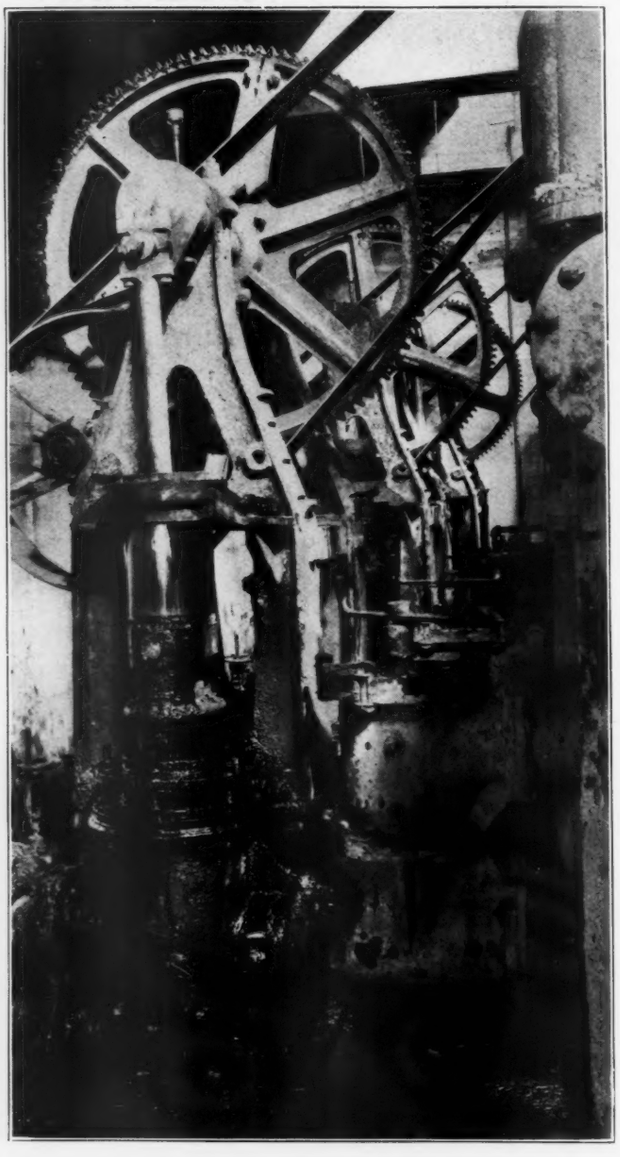


Transfer station between upper and lower sections of aerial tramway

Electric shovel in quarry

There are three stations on the aerial tramway, each provided with storage and loading facilities. The upper, or loading, station receives its limestone by the belt conveyor from the crusher house previously mentioned, and has a storage bin of 500-tons capacity. The middle, or transfer, station is supplied with rock by the buckets in the upper section of the tramway and has a storage bin with a capacity of 100 tons. The lower, or discharge, station is fed by the buckets on the lower section of the tramway. It has a storage bin of 1,000 tons capacity which discharges into railway cars by gravity. All stations are of reinforced concrete construction, the loading and transfer station being rectangular in horizontal section while the discharge station is cylindrical in shape. The span from the loading station to the transfer station is approximately 740 ft. in length and that from the transfer station to the discharge station 1,200 ft. Four buckets are used, each of 4-ton capacity, two running in balance in each section. These are filled through bin gates controlled by Curtis compressed-air cylinders. The buckets run on 4-wheel ball-bearing trucks and dump through the bottom, the gates closing and locking automatically after dumping. The track cables are 2¼-in. locked-wire ropes; the head-ropes are ⅞-in. Hercules Red Strand cables, and the tail ropes ¾-in. special steel cables. The head-ropes at both the loading and the transfer station pass 3½ times around a pair of 8-ft. sheaves. These sheaves have 9-in. braking surfaces, both above and below their rope grooves upon which asbestos-lined band brakes are applied by weights.

The aerial tramway requires but two operators, one at the loading station and one at the transfer



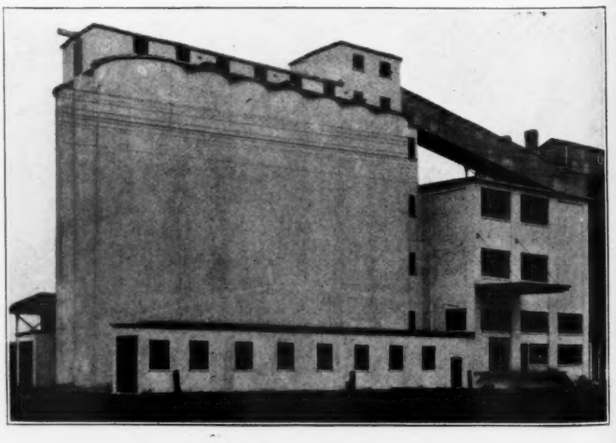
Plunger slurry pumps

station. An operator fills a bucket by manipulating the gates of the storage bin, which operate by compressed air applied through Curtis cylinders. He then lowers the loaded bucket, which is partially balanced by the rising empty bucket in the same section. Compressed air was originally used for braking during lowering, but was abandoned in favor of gravity brakes which the operator can regulate with greater nicety. The operator watches the sinking and rising buckets and regulates their speed by the amount of pressure he exerts upon the brake lever. Full braking is applied when the empty bucket reaches its proper loading position beneath the storage bin. The upper section is considerably shorter than the lower, but it was deemed advisable for the sake of uniformity to use buckets of the same size in each section. The required capacity could therefore be secured by only partially loading the buckets in the upper section, so the control sheaves of this section were each originally equipped with but one 9-in. brake ring. However, it was later considered advisable to operate the upper section with full buckets, and a second set of brakes was added, making the control for the upper section exactly the same as for the lower. The first limestone was lowered over this tramway on May 15, 1929. Since that time, the minor improvements noted above have been made, and the tramway is now giving entire satisfaction, easily exceeding its rated capacity of 150 tons per hour.

The Cement Mill

The cement mill is located at Bellingham, Wash., a city with a population of more than 35,000. The mill is situated 2 mi. northwest of the city center on the shore of Bellingham Bay, a branch of Puget Sound. It has transportation connections with three railroads—the Chicago, Milwaukee, St. Paul and Pacific; the Great Northern, and the Northern Pacific—and has a company-owned wharf for making shipments by water. The raw materials used by the plant are limestone, clay, gypsum, and coal. Crushed limestone is shipped to the mill over the Chicago, Milwaukee, St. Paul and Pacific railroad from the quarry 30 mi. to the northeast, which has already been described. Shipment is made in 50-ton hopper-bottom steel railway cars. The company owns 50 of these cars and is at present loading and stripping 14 cars daily. Clay is obtained from the company's own pit at Brennan, Wash., 5 mi. north of the mill, on the Great Northern railroad. The clay is excavated with a 17-ton Industrial Works locomotive crane equipped with an orange-peel bucket; and loaded into Hart convertible cars which are shipped to the mill. Gypsum is purchased from the U. S. Gypsum Company and the Standard Gypsum Company of Seattle. Coal is supplied by the Bellingham Coal Company.

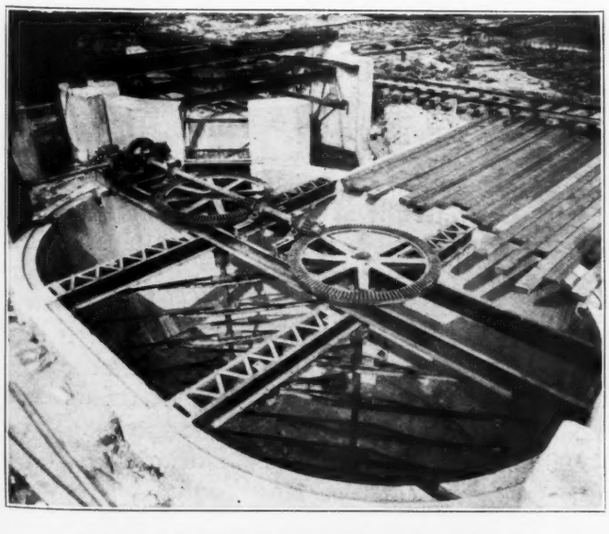
Upon arrival at the plant, the cars loaded with limestone are spotted for unloading by a 35-hp. Vulcan coal-burning 4-driver locomotive, which hauls them up a trestle with a 3 per cent grade to the top of the limestone storage building. They



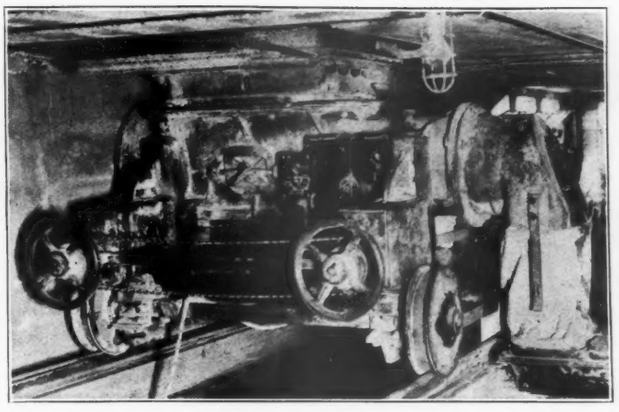
New storage and packing house

are then bottom-dumped into the 9,000-ton limestone storage. The limestone is reclaimed from storage by drawing it through hoppers onto a 20-in. Goodrich belt conveyor driven by a 5-hp. General Electric motor. This conveyor discharges into the boot of an 18-in. by 24-in. Link-Belt pan conveyor, 200 ft. center to center, driven by a 15-hp. General Electric motor. This pan conveyor elevates the limestone and distributes it to the raw mill bins above the Kominuters which perform the first stage of the grinding. Reciprocating feeders regulate the flow of the limestone from the raw mill bins to the Kominuters. General Electric motors are used throughout the mill, with the exception of the finish grinding section, where another make of motor is employed to run the Unidan mill.

The cars filled with clay are unloaded by a 5-ton Toledo electric crane equipped with a 2-cu. yd. Brownhoist clamshell bucket. This crane serves not only to distribute the clay in the 8,000-ton clay storage, but also to feed it to the wash mill hoppers. When unloading cars, it delivers as much clay as possible directly to the wash mill, thus eliminating rehandling. In the 26-ft. wash mill, the clay is mixed with 58 per cent water and stirred until thoroughly disintegrated. This slurry-like mixture is stored in a 15-ft. by 20-ft. by 40-ft. agitating basin to prevent settling of the clay. From the agitating basin, the mixture is pumped by a 9½-in. 2-cylinder back-geared plunger pump to the clay feeders above the Kominuters. These clay feeders are of the ferris-wheel type and feed the Kominuters through pipes, the excess flowing back by gravity to the agitating basin. Wash mill, agitator, and pump were manufactured and supplied by F. L. Smidth and Company, as were also the Kominuters and tube mills used for both raw and finish grinding and in the coal mill. One 75-hp. motor drives the wash mill, the agitator, and the pump.



Agitating basins (foreground) and wash mill



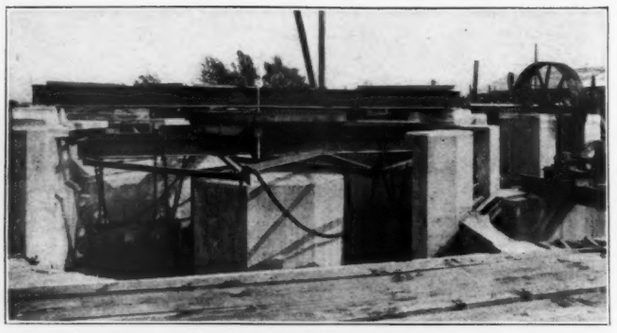
Portable bin-unloader

Raw Grinding

Raw grinding is accomplished in three stages by three types of grinders. The first stage employs three No. 85 Kominuters charged with 5-in. steel balls and each driven by a 125-hp. motor. Crushed limestone, disintegrated clay, and water are fed into them in the proper proportions to obtain the desired slurry. The proportion of limestone to clay is about 4½ to 1, and the percentage of water in the mixture about 34. Each Kominuter is in closed-circuit with a Trix separator which returns the oversize to the Kominuter and sends the undersize forward to the second grinding stage. The second stage of grinding takes place in a 7-ft. by 22-ft. No. E20 tube mill charged with 1¼-in. steel balls and driven directly by a 300-hp. synchronous motor. The third and final stage of raw grinding is effected by two 6½-ft. by 10-ft. No. 18 short Cylpeb mills which are charged with Cylpebs and each driven by a 200-hp. motor through a Lenix drive. The slurry from the two Cylpeb mills is drawn off into any one of three 200-bbl. correcting basins 8 ft. in depth. Here the slurry is analyzed and the proper mixture for burning is calculated. Mixing is accomplished in a 1,200-bbl. mixing basin 15-ft. deep into which proper proportions of different slurries are drawn by gravity. An Ingersoll-Rand 12-in. by 10-in. Type ERL air compressor supplies air for raising the corrected slurry to the storage tanks under the kilns in the kiln building. A 15-hp. motor runs the correcting basins, while a 75-hp. motor operates the mixing basin and compressor.

Burning and Cooling

Three Vulcan kilns, each 170 ft. 4 in. in length, 9 ft. in diameter at the feed end, and 10 ft. in diameter throughout the burning zone, are used. Each kiln is driven by a 50-hp. electric motor through a belt drive and is provided with a stack 180 ft. in height. There are three Smidth mechanically-stirred slurry tanks beneath the kilns, each holding 2,000 bbl. and equipped with a 9-in. Smidth slow-motion plunger-pump for raising the slurry to the ferris-wheel feeder of its kiln. Pul-



Wash mill

verized coal has been used as kiln fuel for many years, but the old appliances for burning fuel oil are still in position and might be used in an emergency. The clinker is cooled in three 40-ft. Smidth double-shell pressure coolers, one of which is located beneath each kiln. Two of the coolers are driven by one 75-hp. electric motor and the third by a 35-hp. motor. The cold air is furnished by three American blower fans. After the air has circulated through the coolers and become heated, it is forced up through the kiln-hoods and enters the kilns with the pulverized coal and the compressed air which feeds it, thus reducing the fuel consumption. The coolers discharge the clinker into an 18-in. by 24-in. Link-Belt conveyor, 225 ft. center to center, driven by a 15-hp. motor. This conveyor carries the cooled clinker to the clinker-storage building which has a capacity of 170,000 bbl. There is a 15-ton Bay City locomotive crane in the clinker storage building which is employed not only in handling clinker, but also in unloading gypsum from railway cars. A 16-in. manganese screw conveyor, made by Jos. D. Christian of San Francisco, and run by a 10-hp. motor is situated beneath the clinker storage. It reclaims the clinker from storage and transports it to the clinker bins at the top of the finish grinding mill. This conveyor is likewise used to transport gypsum to a bin alongside the clinker bins. Clinker and gypsum are proportioned, by hand weighing, into a steel car which is moved by air hoist and dumped into the finish grinding bins.

Coal is brought to the plant by railway from neighboring coal mines in the company's own gondola cars and dumped from a trestle in the coal storage shed. The coal is handled from storage by a 12-ton Industrial Works locomotive crane with a 1-cu. yd. bucket into bottom-dump cars which discharges into the coal-mill hopper. An elevator takes the coal from the mill hopper to the wet coal bin above the dryer. Drying is performed by a 6-ft. by 50-ft. Cummer dryer, driven by a 15-hp. motor, using raw coal as fuel. The dried coal is ground in a No. 66 Kominuter and in a No. 18 tube mill powered by a 200-hp. motor. There are four elevators in the coal mill, two using 10-hp. motor, one a 5-hp. motor, and the other a 7½-hp. motor. The elevators were made by the Webster-Brinkley Company of Seattle, from No. 84 chain with 7-in. by 14-in. buckets. There is a separate 10-ton pulverized-coal feed-tank for each of the kilns. Feeding is accomplished by drawing the pulverized coal from a tank by means of a 6-in. Smidth screw conveyor and discharging it into a pipe through which air is forced by a Garden City cycloidal fan. Each kiln is fed independently from its own tank, a practice which is conducive to both safety and economy.

Finish Grinding

Clinker and gypsum are ground together by one of two methods—using Kominuters followed by Cylpeb mills, or using a Unidan mill alone. There are two Kominuters, each of the same size, charge, and motor as those employed in raw grinding, and two No. 18 standard Smidth mills each driven by a 200-hp. motor. The Unidan mill has a capacity equal to the two Kominuters and the two Cylpeb mills combined. It is divided into three compartments, the first of which is charged with 5-in. balls like the Kominuters, the second with 1¼-in. balls, and third with Cylpebs. A 442-kw. Titan electric motor drives the Unidan mill through a Symetro reduction gear. A 16-in. Brinkley screw conveyor moves the finished cement to the end of the finish grinding building and delivers it to a 20-in. 6-ply Goodrich belt conveyor which carries it upwards at an angle of 30-deg. to another 20-in. Goodrich belt conveyor above the finished storage silos. The conveyors and elevators in the finish grinding building are all driven by one 50-hp. motor, while a 10-hp. motor drives the belt conveyor to the finish storage.

Cement Storage and Packing

The old cement storage consisted of 10 silos, each with a capacity of 10,000 bbl., arranged in rows of five. These are located on either side of the belt conveyor coming from the finish grinding building. The packing house is directly beneath this conveyor. Cement is drawn from the bottoms of the silos, by machines called Exbiners, into a 16-in. Brinkley screw conveyor operating in a tunnel beneath the row of silos. There are two Exbiners, both delivering to the same screw conveyor. The screw conveyor discharges the cement into an elevator which takes the cement to the top of the packing house, where it is delivered to another screw conveyor which feeds two large steel bins. Under each of these bins are two Bates 4-tube packers for sacking the cement. After packing is completed, the filled bags automatically drop upon a belt conveyor which delivers them to railway cars for shipment. There are railway loading tracks on each side of the packing house, making it possible to load 4,000 bbl. of cement on a single switch.

New storage and packing facilities have just

(*Continued on Page* 50)

Delegates from Four Missouri Cement Mills Attend St. Louis Regional Safety Meeting

REPRESENTATIVES of four Missouri cement plants gathered at the Hotel Coronado at St. Louis, Mo., on February 25, for an all-day meeting devoted to the promotion of safety and the prevention of plant accidents. The following plants sent delegates: Alpha Portland Cement Co., Jefferson Barracks, Mo.; Marquette Cement Manufacturing Co., Cape Girardeau, Mo.; Missouri Portland Cement Co., St. Louis, Mo., and the Universal Atlas Cement Co., Hannibal, Mo.

Hiram Norcross, vice-president and general manager of the Missouri Portland Cement Company, was general chairman of the meeting, which was the fourth on the Portland Cement Association's schedule of fifteen to be held this year throughout the country. Joseph T. Davis, head of the St. Louis Safety Council, was the first speaker. Mr. Davis' subject was: "The Common Ground of Safety."

The progress made in accident prevention work by the public-utility power companies was next reviewed by Herman Spoehrer, secretary of the Union Electric Light and Power Company of St. Louis. Dr. George F. Chopin, plant surgeon of the Missouri Portland Cement Company, explained to the delegates the principles of first-aid and what to do in emergencies about the plant. How well his company has trained its workers in that regard was ably demonstrated later in the day when the Missouri company's first-aid team put on a splendid demonstration of their work.

Discuss Departmental Hazards

Luncheon was served at 12:15 o'clock in the French room of the hotel and the session was resumed at 2 p. m. The entire afternoon was taken up with discussions of safety hazards in definite plant departments. Leaders of the discussions were as follows:

"Safety In Use of Explosives," by R. H. Summer, technical representative, E. I. duPont de Nemours and Co.

"Safe Practice in Shop and Repair Work," R. A. Hoffman, superintendent, Universal Atlas Cement Co., Hannibal, Mo.

"How About Your Mill Housekeeping," Edward Hemmer, safety engineer, Alpha Portland Cement Co., Jefferson Barracks, Mo.

"Storage Packing and Shipping Hazards," Edward Jarman, packing-house foreman, Missouri Portland Cement Co., St. Louis, Mo.

Some of the interesting points brought out in the discussion follow:

Crushing Accidents

The use of large gyratory crushers, or other types of crushers served with feeders, was urged toward eliminating crusher accidents. Many small crushers are used which introduce the hazards of punching mud and rearranging of cascading rocks. When cascading is broken up by lifting large rocks with hoist and chains it can be best done by pulling the chain under the stone with a long, light rod having a hook at the end. The chain can then be pulled up and fastened. It is best to stop the crusher a moment for the operation. If these rules are followed, the hands and arms will be safe and there is no danger of the feeder falling into the crusher. Crusher operators who are called upon to punch or to sledge rocks to make them fall into the crusher should use suitable safety belts.

The other mechanical equipment in the crusher building can be safeguarded in the customary way and with constant teaching of safety rules and the observance of them it should not be a particularly hazardous place in which to work.

Air Hoists

A compressed-air hoist is a convenient tool to use on a shop jib crane. Sometimes the hose on such a hoist slips from its connections, is cut, or breaks loose for one reason or another. A loose end of such a hose under pressure has been known to cause severe injuries to workers. If the jib post is drilled so that the air piping can be connected to it through a universal pipe joint and then the air piped from the side of this post to a point midway of the jib beam, the length of the hose is so reduced that a flying end will not reach the operator.

Machine Tools

All belts, pulleys, gears and other moving parts of machines should be well guarded with substantial guards constructed in a workmanlike manner. Countersunk set screws should be used in place of those with projecting heads. Many shop machines have individual motor drives. Motor for such drives should be operated through enclosed safety switches with push button control. Where a belt from the motor drives the machine it may be safely housed by heavy sheet metal guards of welded construction. The housing should be provided with a door for the inspection and repair of the belt.

It is easy for an operator of a slow moving machine to allow his attention to wander from his work. When feeding plates to bending rolls a man may hold onto the piece too long, and catch his hand in the rolls. To prevent this, a flexible guard

or scraper made from rubber belting may be so mounted as to push his hand from the plate.

The weight of the flywheel of a punch-press causes it to idle after the power has been shut off. Under certain conditions this idling is hazardous. A hand-operated brake applied to the flywheel will overcome this hazard. The gears, motor, flywheel, etc. should be enclosed, and the brake should be operable from without the enclosure.

Storeroom

The storeroom is one place where the management may show its interest in safety. Well-lighted bays and orderly arrangement of stock are evidences of good housekeeping. Such practices will prevent many accidents. They will also stimulate interest in safety. They show that the management is for absolute safety at all times.

Accidents often occur when men are under heavy muscular strain and something slips. Heavy stores articles should be stored so that they may be removed with the minimum physical exertion. Bar-steel stock in the larger sizes is heavy. Because of its weight and shape those handling it must guard against mashed fingers. Racks can be provided so that the heavier bars rest on rolls of such short sections that an individual bar may be readily withdrawn with minimum exertion and without interference of adjacent bars. Care should be exercised in erecting racks to insure a slight incline forward from the back end so that the bars cannot roll out of the rack unless pulled.

Persons handling plates standing on edge often mash their fingers or otherwise injure themselves. Racks similar to those for bar stock may be provided for plate and sheet stock except that fixed rolls are not applicable. With such racks it is always easy to withdraw from the pile the top sheet of the desired gauge. Should the plate be heavy, pipe rolls may be placed under it. The lower sections of these racks should be reserved for the heavier pieces.

In the space available in a storeroom it is difficult to remove heavy cable from a reel. Someone made his brain save his brawn and likewise his skin when he provided rolls upon which to turn the spool when unreeling the cable. To elevate the spool to a position in which it rests between the rolls, it is rolled up a slightly inclined, rough surface plate. When in that position simply pulling the cable end will cause the spool to revolve, unreeling the cable. After the desired length has been cut off and the loose end fastened, the roll next to the inclined plate is locked by a hand screw. The spool can then be easily rolled off the stand and another put on if desired.

G. S. Brown, president of the Alpha Portland Cement Co., was toastmaster at the safety dinner which was held at 6:30 p. m. in the French room of the hotel.

New Booklet Instructs Workers in Matters of Health

The National Safety Council has just issued a copyrighted booklet entitled "The Healthy Worker." It comprises a series of health talks by Dr. C. O. Sappington, director of the Industrial Health Division, addressed to employees.

The contents have two main headings: "The Care of the Body" and "Common Abnormal Conditions." The first group of talks covers sight, hearing, skin, teeth, mouth, exercise, diet, sleep, refreshment, dress, and periodic health examinations. The latter group covers headaches, constipation, weight, colds, indigestion, wounds, tonsils, and nerves.

Profuse sketches emphasize the topics discussed. The headlines are snappy, as "Be True to Your Teeth or They Will Be False," concerning the care of teeth; and "A Foot-Note," discussing shoes and socks.

Members of the Council may purchase these booklets for distribution to their workers at most reasonable prices. The attention of our readers is called to the new address of The National Safety Council, 20 N. Wacker Drive (the Civic Opera Building), Chicago, Ill.

Olympic Cement Plant

(*Continued from Page* 48)

been completed, increasing the capacity of these sections of the plant by 50 per cent. The new storage and packing building has a capacity of 50,000 bbl., uses Fluxo pumps instead of Exbiners to empty its eight 20-ft. diameter silos and intersection, and is equipped with two Bates 4-tube packers. The combined finished cement storage now, therefore, is 150,000 bbl.

F. L. Smidth and Company, as already stated, designed this plant, and furnished the Exbiners, Unidan, Symetro, and Fluxo pieces of equipment.

Personnel and Labor

The Olympic Portland Cement Company is a British concern. Balfour, Guthrie and Company, with offices in the Dexter-Horton building at Seattle, is general manager and sales agent. W. P. Cameron is its representative at that office. A. F. Krabbe is general superintendent and has his home and office at the Bellingham plant. He has been in charge of the Olympic plant from its inception. Associated with Mr. Krabbe at Bellingham are: Charles Shepard, general foreman; Paul Kayler, chief electrician, and Frank Ronk, chief chemist. F. E. Ristine is superintendent of the limestone quarry. The company employs about 150 men, including some 125 at the mill and 25 at the limestone quarry. A safety committee is active at all times, functions smoothly and gives training in first aid measures.

Aerial Tramway Transports Raw Material Five Miles to Plant of Northwest Magnesite Company

Chewelah, Wash., Plant Is Greatest Producer of Magnesite in U. S.; Company to Manufacture New Building Board

AT THE beginning of the Twentieth Century, magnesite was being produced from several quarries in Stevens County, Wash., under the impression that it was marble. In 1903, it was discovered that the "black marble" being quarried by the United States Marble Company and the "pink marble" being quarried by the North American Marble and Onyx Company both had the composition of magnesite. The product of these quarries proved unsuitable for commercial purposes and they soon ceased operations, but geologists did not lose sight of the fact that magnesite existed in Stevens County. At that time, however, these deposits were without commercial value, since there was a large supply of cheap foreign magnesite available and the Washington magnesite was too far from centers of consumption.

The World War increased the demand for magnesite and at the same time decreased the foreign supply, with the result that it rose rapidly in value. The United States Marble Company had quarried magnesite "marble" from its Keystone quarry from 1898 to 1903, but when the war opened, this quarry was lying idle. In 1915, R. S. Talbot of the Inland Empire Paper Company of Spokane, came into possession of specimens from the Keystone quarry which, upon analyis, proved to be brucite, or magnesium hydrate. An examination of the quarry showed the brucite to be surrounded by a magnesite deposit of commercial value, so Mr. Talbot acquired title to it and began prospecting for further deposits. He organized the Washington Magnesite Company, which began shipping magnesite from the Keystone quarry in November, 1916. Early in 1917, the Keystone quarry was abandoned in favor of the Finch quarry which had been acquired by the Washington Magnesite Company and was nearer to the railroad. The Finch quarry, now the greatest magnesite mine in the United States, was originally located as a limestone quarry; and it is said that so discouraged did the first owner become with the property, that he once made an unsuccessful attempt to trade it for a second-hand Ford car!

On May 1, 1917, the Washington Magnesite Company was taken over by the Northwest Magnesite Company in which the Crocker National Bank of San Francisco holds the controlling interest, R. S. Talbot being retained as president of the new company. Later that year the Northwest Magnesite Company built a 3-kiln calcining plant near Chewelah and constructed an aerial tramway from its Finch quarry to this plant, entailing an outlay of more than $600,000. The production of magnesite by the Northwest Magnesite Company in 1917 was the largest in the United States, and it remained in the position of largest producer until 1920 when all the Washington producers shut down on account of unfavorable market conditions. In 1919, the Northwest Magnesite Company increased the number of its kilns from three to six, and in 1923 installed a Cottrell treater to prevent crop

Waste dump, crushing plant, and loading station for aerial tramway

J. C. Hutchinson, plant superintendent

damage by calcined magnesite dust from its plant. The tariff of 1922 revived the magnesite industry in Washington, and in 1923 the Northwest Magnesite Company was again the largest magnesite producer in the United States. In December, 1923, it purchased the Allen, Moss, Woodbury, and Red Marble mines from the American Mineral Production Company, and is at the present time contemplating the construction of an aerial tramway from the Allen and Moss mines to the Finch Quarry which will enable it to deliver magnesite from these mines to its Chewelah calcining plant cheaply.

The magnesite quarries of the Northwest Magnesite Company lie along the southeastern flank of the Huckleberry Mountains to the southwest of Chewelah in Stevens County. Chewelah is a town of about 1,500 inhabitants situated on the Great Northern railway, 64 miles north of Spokane. The calcining plant of the company is located upon the railroad and highway, 1½ mi. south of Chewelah. This plant is connected with the Finch quarry to the west by an aerial tramway 5 mi. in length and by a road 7 mi. long. The other quarries lie along a line running southwestward from the Finch quarry, and each is successively farther from the railroad.

All the magnesite now being produced by the company comes from the Finch quarry, which is served by the aerial tramway running from its crushing plant to the calcining plant of the company 5 mi. away. It is planned, however, to erect an aerial tramway ½ mi. in length connecting the Allen and Moss quarries with the crushing plant of the Finch quarry and to quarry magnesite from these quarries in the near future. The Finch quarry lies upon the eastern flank of a hill near its crest. The magnesite lens is about 1,000 ft. in length and 250 ft. in maximum width. In composition it ranges from dolomite to magnesite, with varying amounts of silica as an impurity. These variations occur in a general way in zones parallel to the dip, but the contents of these zones themselves are variable in composition.

Stripping

Overburden is stripped and loaded into 1-cu. yd. Union Iron Works side-dump quarry cars by a No. 21 Marion 28-ton, ¾-cu. yd. electric shovel mounted on caterpillars. These cars are hauled over tracks to the waste dump, in trains of two to six cars, by horses. Underground development is in progress for the purpose of opening up glory holes. Gardner-Denver wet drifters and No. 7 Waugh stopers, converted from dry to wet, are employed for drilling this underground work, and Du Pont Special gelatin dynamite of 40 per cent strength is the explosive used.

Drilling and Blasting

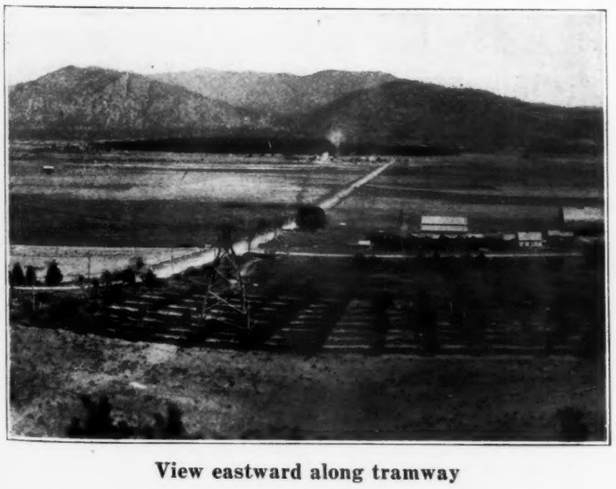
The magnesite is broken in three 40-ft. benches. Drilling is done with Denver 55, 92 and 93 dry sinkers. Vertical holes are sunk 25 ft. in depth, 8 ft. to 10 ft. apart, and with 8-ft. to 10-ft. on the collar and twice that on the toe. Toe shots are drilled horizontally 18 ft. to 20 ft. Magnesite screenings are used for tamping, about 15 ft. of tamping being used in 20-ft. holes. Compressed air for the quarry drills, as well as for the drills employed in underground development and for the blacksmith shop, is supplied by two Sullivan Class

Crushing plant and tailing dump. Allen quarry on hill in background

WJ3 2-stage air-compressors. One is driven by a 75-hp. motor and furnishes 480 cu. ft. of free air per minute. The other is operated by a 100-hp. motor and supplies 520 cu. ft. A third compressor of the same make, run by a 75-hp. motor, was recently installed for carrying the increased load which will result when the Allen and Moss quarries are worked. Electric power to run these motors and the other motors of the company is purchased from the Washington Water Power Company. The drill-holes are chambered from four to six times with Du Pont quarry gelatin dynamite of 40 per cent strength, cooled by air blowpipe, and loaded with 1½ to 2 boxes of 30 per cent quarry gelatin dynamite each. They are fired with Du Pont electric caps using the power circuit. From six to eight holes are commonly fired simultaneously, and sometimes as many as 18 holes. Secondary blasting is done by blockholing and loading with a light charge. All of the broken material is hand-sorted and loaded into 2,800-lb. V-bottom side-dump cars which are then trammed by hand to any one of six magnesite chutes running to a tunnel 200 ft. below the quarry floor, or to the waste dump, according to their contents. Two men will hand-sort and tram from 25 to 28 cars of magnesite and waste, on an average in one shift.

Primary Crushing

The coarse crushing of the magnesite and removal of fines is performed at a plant located at the Finch quarry. The magnesite is drawn off in the proper proportions through the six magnesite chutes in the tunnel beneath the quarry into V-body rocker-dump cars. These cars are trammed to a 75-ton receiving bin located above the primary breaker at the crushing plant. From this bin, the magnesite is fed to a Traylor Bulldog jaw crusher, equipped with a spray and driven by a 50-hp. motor, which reduces to fragments of 6-in. maximum diameter. A Union Iron Works 20-in. belt conveyor, 180 ft. center to center, and driven by a 20-hp. General Electric motor, transports the broken magnesite to a Link-Belt scrubber and trommels.



View eastward along tramway

M. D. McIntosh, mine superintendent

The scrubber is cylindrical, 4 ft. in diameter by 6 ft. in length, and is supplied with water by a Byron Jackson centrifugal pump of 400 g.p.m. capacity, run by a 10-hp. General Electric motor. From the scrubber, the magnesite passes to a 6-ft. conical revolving screen which varies in diameter from 2½ ft. to 4 ft. and is perforated with 1½-in. round holes. The oversize goes to the secondary breakers, and the undersize to a second similar trommel with ¼-in. round holes. The oversize from the second trommel by-passes the secondary breakers, while the fines, which usually run high in impurities, are sent to the waste dump. Scrubber and trommels are driven by a 25-hp. electric motor. Both secondary breakers are No. 5 Gates gyratory crushers, set to break to about 2-in. maximum diameter and driven by a 75-hp. motor. A 7-in. by 16-in. Union bucket elevator driven through line shafting by the crusher motor, raises the product of the secondary crushers, together with the material which by-passes them, to a 4-ft. by 10-ft. trommel perforated with 2-in. round holes. The oversize from this revolving screen is returned to the gyratories, and the undersize passes through a home-made automatic sampler to a 300-ton tramway loading bin. The majority of the conveyor belts and transmission belts in both this and the Chewelah plant were made by the United States Rubber Company.

Aerial Tramway

The commercial success achieved by the Northwest Magnesite Company has been due, in part, to

Loading the stripping with electric shovel

the cheap transportation from its Finch quarry to its calcining plant on the railroad, afforded by an aerial tramway. This tramway was designed and constructed by the Riblet Tramway Company of Spokane. It is 5 mi. in length, receiving its feed from a 300-ton loading bin at the Finch quarry crushing plant and delivering it to a 1,000-ton storage bin at the Chewelah calcining plant. The tramway is driven by a 50-hp. motor, with some assistance by gravity. It is provided with 100 buckets, each of 1,200-lb. capacity, and will deliver 200 tons in 8 hr. A ⅝-in. haulage rope is employed; and the tram track is made up of locked-coil cables of 1⅜-in. and 1-in. diameters. The tramway cost approximately $60,000.

Secondary Crushing and Screening

The aerial tramway takes the coarsely crushed and washed magnesite (¼-in. to 2-in. in diameter), from the crushing plant at the Finch quarry to a 1,000-ton receiving bin at the Chewelah plant. The magnesite is withdrawn from this bin through six hoppers to six belt feeders, driven by one 7½-hp. General Electric motor. These feeders discharge their loads upon a Union Iron Works 20-in. 6-ply collecting belt conveyor, which has 90-ft. centers and is driven by a 5-hp. motor. This conveyor feeds a similar belt conveyor, 70 ft. center to center, which is inclined and equipped with a Cutler-Hammer 15-in. by 36-in. 220-volt magnetic separator for removing tramp iron. This second belt feeds a pair of 42-in. by 16-in. Allis-Chalmers crushing rolls set at ½-in. The product of the rolls is raised by a 68-ft. bucket elevator, composed of 7-in. by 14-in. buckets on a 16-in. 8-ply belt, to two 3-ft. by 4-ft. Impact mechanical vibrating screens, fitted with ½-in. screening surfaces, furnished by the Colorado Iron Works. The oversize returns to the rolls which are thus placed in closed circuit with the screens. The undersize from the first set of vibrating screens is raised by a second bucket elevator, to a second set of Impact screens consisting of four 3-ft. by 4-ft. screens covered with 8-mesh Tyler Ton-Cap screen cloth. The oversize from the second series of vibrating screens passes to a second pair of 42-in. by 16-in. Allis-Chalmers crushing rolls set at 1/16-in. The product of this second pair of rolls goes back to the second bucket elevator, thus placing the second pair of rolls in closed circuit with the second set of vibrating screens. Inclined belt conveyor, rolls, screens, and bucket elevators are all run by one 2,300-volt 250-hp. electric motor. The minus 8-mesh magnesite from beneath the second group of vibrating screens collects in a 150-ton crushed magnesite bin.

Mixing With Iron Ore

The magnesite from the Finch quarry is too low in iron content to produce satisfactory ferromagnesite on direct calcination, so iron ore is added before burning. Magnetic iron ore, purchased at a mine north of Chewelah near the Canadian boundary, is used for this purpose. The iron ore comes to the plant in railway cars which are unloaded upon a platform. It is then passed through a Blake jaw crusher set at 2-in. and delivered by a bucket elevator composed of 5-in. by 8-in. buckets mounted upon No. 74 chain, and having 40-ft. centers, to a pair of 30-in. by 12-in. Union Iron Works crush-

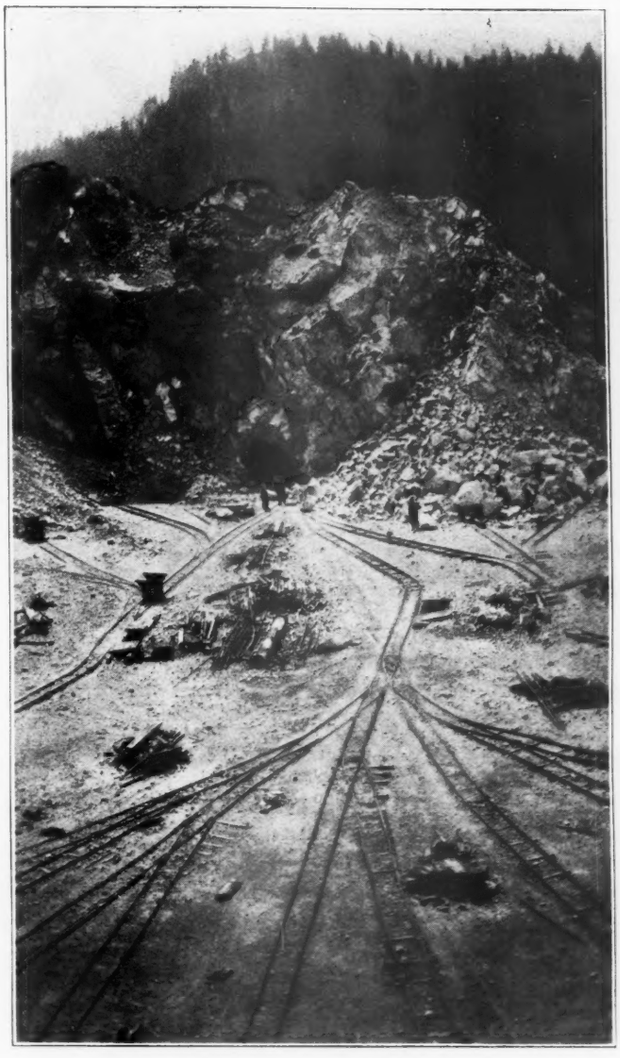
Hand-sorting and loading into side-dump quarry cars

ing rolls set at ½-in. The crushed ore is then raised by a bucket elevator on 50-ft. centers to a 60-ton storage bin. Jaw crusher, rolls, and bucket elevators are all driven by one 35-hp. motor. The crushed iron ore is drawn from this bin and pulverized until 60 per cent passes 10-mesh in a 42-in. Fuller mill driven by a 100-hp., 2,300-volt motor. The pulverized iron ore is raised by bucket elevator and carried by a 12-in. screw conveyor 40 ft. in length to a 40-ton pulverized iron ore storage bin. Pulverized magnesite and iron ore are weighed out on either of two 3-ton Fairbanks-Morse scales into 1-ton scale hoppers. About 40 lb. of iron ore are added to 1,960 lb. of magnesite and the materials are mixed by the handling which ensues. A 20-in. belt conveyor carries the magnesite and iron ore to a bucket elevator which discharges upon a 16-in. belt conveyor delivering its load to any one of six 60-ton kiln-feed bins or to a 1,000-ton auxiliary storage bin. The mixture in the storage bin can be drawn into the bucket elevator and delivered to the kiln-feed bins in case of a breakdown in the crushing plant. The kiln-feed bucket elevator is composed of 7-in. by 15-in. buckets, mounted on a 16-in. 8-ply belt on 55-ft. centers, and is driven by a 15-hp. motor.

Burning

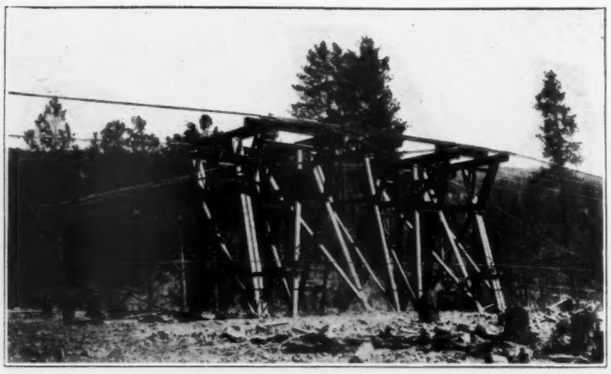
There are six kilns, fed individually from the six kiln-feed bins by a like number of belt feeders, made by the Union Iron Works and driven by the kiln drives. The kilns are similar to those used in the manufacture of portland cement. Five of the kilns are 7½ ft. by 125 ft. and were made by Mosser and Son, while the larger kiln is 8 ft. by 125 ft. and was built by the Bonnot Company. Each kiln is driven by a 40-hp. variable-speed slip-ring motor and lined with Harbison-Walker 6-in. kiln blocks. Pulverized coal is used as fuel and a temperature of from 2,800 deg. to 3,000 deg. is maintained. The kilns operate in pairs and deliver their clinker to three brick chambers, each of which is provided with a bucket elevator to raise the hot clinker to a rotary cooler. The three clinker elevators have 28-ft. centers and are composed of 6-in. by 10-in. buckets on No. 82 chain. Each of the three rotary coolers is 5 ft. by 50 ft. in size and each cooler and its clinker elevator are driven by a 20-hp. motor. The cooled clinker from the three rotary coolers is collected by an 18-in. belt conveyor and discharged into a bucket elevator, which feeds the clinker treatment section. Gases and dust from the kilns pass into flues which remove a part of the dust, the remainder being taken out by a Cottrell treater. Dust is too high in silica and other impurities, however, to be returned to the kiln feed, so it is sluiced to a stockpile for future use. Each kiln has a capacity of from 65 to 70 tons of ferromagnesite in 24 hours.

Utah slack coal is purchased for kiln fuel and is received at the plant in bottom-dump railway cars. These cars dump into a 150-ton track hopper, from which a screw conveyor and elevator carry the coal to a 600-ton storage platform. Additional storage is provided upon the ground beside this platform, the coal being taken to the ground storage and reclaimed from it by means of a Union Iron Works ½-cu. yd. double-drum crab dragline



Quarry floor as viewed from face

Dining room at Finch quarry, with holiday decorations



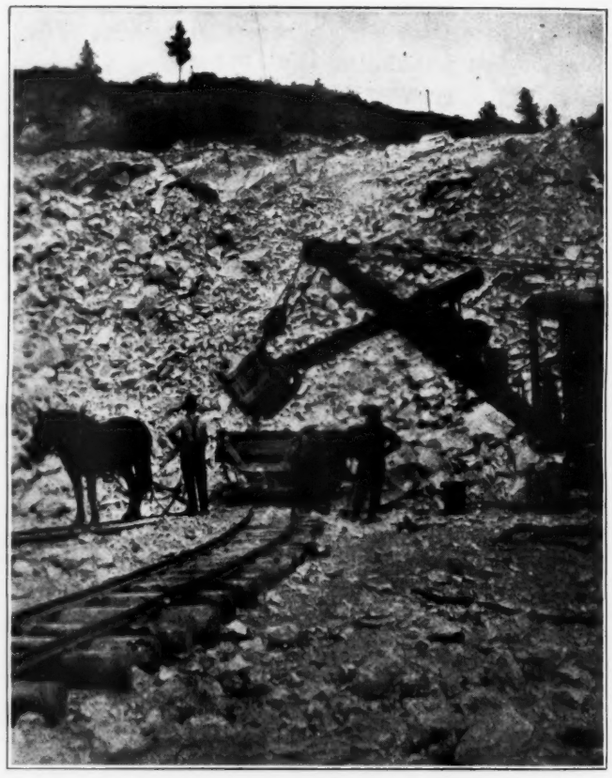
Tension station in aerial tramway

scraper run by a 10-hp. motor. An 18-in. 6-ply Bonnot belt conveyor with 75-ft. centers, equipped with a Cutler-Hammer magnetic head pulley for removing tramp iron, is driven by a 5-hp. motor and transports the coal from the storage platform to a Bonnot chain bucket elevator. This elevator, equipped with 6-in. by 10-in. buckets, is on 35-ft. centers, and is driven by a 5-hp. motor. It delivers the coal to Richardson automatic scales, from which it goes to two Ruggles-Coles direct-fired dryers, run by 7½-hp. motors, which reduce its moisture content to about 2 per cent. The coal from the dryers is delivered to six Bonnot pulverizers and separators driven by 30-hp. motors. Six 45-in. Bonnot exhaust fans with collectors, run by 7½-hp. motors, remove the pulverized coal and deliver it to a 50-ton pulverized coal bin. The coal is removed from this bin by four 6-in. feed screws. Until recently, a single kiln-feed system was in use, by which the pulverized coal was blown to the burners of all six kilns by a 62-in. high pressure fan, and the excess was by-passed back to the storage bin. This system has now been replaced by one employing separate feeds to each kiln and requiring no return of excess coal. Each kiln burner is equipped with its own No. 5 Sturtevant blower, with injector, operated by a 10-hp. 440-volt General Electric motor. This arrangement is more efficient than the old one since it allows a closer adjustment of the individual kiln feeds and is safer, since it reduces the liability to coal dust explosions.

Direct-fired coal dryers

Clinker Crushing

The clinker which is brought from the calcining department by bucket elevators, is delivered to a grizzly composed of 2½-in. by ⅝-in. V-shaped bars, spaced 2 in. apart. Undersize drops into an 80-ton storage bin from which it is fed to an Impact screen with ½-in. square openings. The undersize from this screen is finished ferromagnesite. Oversize from the grizzly slides into a 1-ton pocket, from which it is fed to a 7-ft. by 9-ft. Blake jaw crusher. The crushed material, together with the oversize from the vibrating screen, are both fed to a pair of 30-in. by 16-in. Allis-Chalmers crushing rolls. The product of the rolls is returned to the bucket elevator ahead of the grizzly, thus completing the crushing and screening circuit. Elevator, jaw crusher, Impact screen and rolls are all driven by a single 50-hp. motor. The minus ½-in. finished ferromagnesite is carried by an 18-in. Union Iron Works belt conveyor to a home-made automatic sampler, and then distributed to storage piles in a warehouse of 3,000-tons capacity by means of a 14-in. Union distributing belt conveyor. The ferromagnesite is reclaimed from the storage piles by means of a ½-cu. yd. power scraper similar to that used in the coal storage, which delivers it to a bucket elevator emptying into a 20-ton railroad loading bin above a railway spur track. Loading is accomplished with the help of an ingenious box-car loader of original design. It consists essentially of a belt, with blades attached,



Electric shovel loading stripping into side-dump quarry cars

which runs rapidly about two pulleys and can be moved backward and forward or turned in different directions so that loading may be effected without the necessity of a workman entering the car. The bladed-belt catches the particles of ferromagnesite as they fall from a pipe chute in the bottom of the loading pocket and throws them to the ends of the box-car; while the center of the box-car is loaded directly from the chute.

By-Products

The Northwestern Magnesite Company is at present producing nothing but ferromagnesite, which it ships to steel mills for use in the basic open-hearth process, and also to magnesite brick plants for use in making refractory brick. The company, however, has made quite a study of the possibilities of plastic magnesia, some of this research having been conducted in cooperation with the U. S. Bureau of Mines. Current demand for plastic magnesia is slight, however, and, while some was manufactured at Chewelah a few years ago, it has only been sold in small lots and a supply still remains on hand. There is a Bonnot mill at the Chewelah plant which has been used for grinding plastic magnesia made in the past, and the plant is in a position to supply any new demand for this material which may arise.

The company is now constructing a plant which will utilize waste magnesite dust from the kilns in the manufacture of a fireproof insulating material invented in Germany and sold under the trade name of "Heraklith." American rights to the material have been secured. This material is made in the form of boards and is produced by coating wood fibre with oxychloride cement, the latter being formed by treating caustic calcined magnesia with magnesium chloride solution.

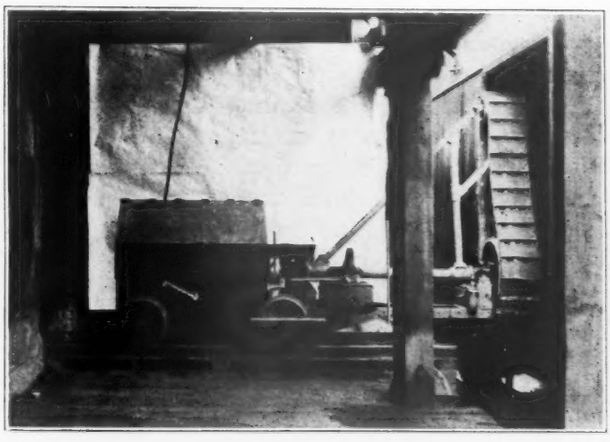
Heraklith was developed at a magnesite plant in southern Austria. It is now being successfully marketed from two foreign factories—one at Ferndorf, Austria, and one at Simbach, Bavaria. The combined output of these two plants is approximately 400,000 bd. ft. per day. The boards are made ½ meter wide by 2 meters long and in thicknesses of about 1, 2, 3 and 4 in. They are used for insulation, partitions, outside and inside sheathing, etc. When used outside, Heraklith board is stuccoed, and when used inside, it is usually plastered. In neither case does it require lath, wire, or other device for holding the stucco or plaster. The material weighs about 2 lb. per bd. ft. It is highly fireproof and an excellent insulator. The process of manufacture consists in making a coarse grade of excelsior out of inferior logs which are worthless as lumber. This excelsior is cemented with magnesite cement and formed into board. The unit which is now under construction by the Northwest Magnesite Company will have a capacity of about 85,000 bd. ft. per day in thicknesses of 1, 2, and 3 in. The boards will be 2 ft. in width by 5 ft. 4 in. in length, so that they will span the usual 16-in. spacing of studs.

Finch quarry and crushing plant

Personnel

R. B. Rogers is manager of the Northwest Magnesite Company. M. D. McIntosh is mine superintendent and Arthur Sargent quarry engineer. J. C. Hutchinson is plant superintendent at Chewelah. From 140 to 150 men are employed in two shifts at the Finch quarry and its crushing plant. Well-constructed living quarters and a club room have been built for the accommodation of the men. As much as 16,000 tons of magnesite may be quarried monthly, the amount depending upon the number of kilns in operation.

The Chewelah plant employs about 100 men. Its six kilns have a monthly capacity of about 12,000 tons of ferromagnesite, but only a few of them are commonly in operation.



Box-car load about to enter a car

Developing the Non-Metallic Industries of the West

By WALTER W. BRADLEY, State Mineralogist of California

[*The following excerpts are from a lengthy article in the December issue of* MINING CONGRESS JOURNAL. *The author classifies the non-metallic minerals as structural materials and industrial materials.—Editor.*]

Structural Materials

THE Pacific coast is well supplied with structural materials. Practically any type or style of structure is possible with the wealth of local materials available. Deposits of granite, marble, and other building stones in great variety of colors and texture are widely distributed throughout this territory. Although some of these deposits are at considerable distances from cheap transportation facilities, yet the resources are potential, and will some day become economic when population and the demand call for it. The mineral substances grouped under this heading are those directly employed in building and structural work. Some of these commercial minerals classed as "industrial" are more or less utilized in "structural" applications, but they have other uses as well.

Asphalt and Bitumen

The native bitumens or asphalts, including gilsonite, elaterite, and the mineral wax, ozocerite, are mined in important quantities in Utah. They are especially valuable as constituents in paints, waterproofing, and insulating compounds, baked enamels for auto-body finishing, and in the manufacture of rubber products.

Cement and Concrete, Including Crushed Rock, Sand, and Gravel

Today's extensive program of concrete road building, and the construction of great monolithic dams for hydroelectric and irrigation plants, such for instance as the proposed Boulder Canyon Dam on the Colorado River in Arizona, to say nothing of reinforced-concrete structures of all sizes and types, would be out of the question without portland cement, which, in turn, requires the broken stone and sand to complete the aggregate. Cement today in California has attained a position second only to petroleum in point of annual value of its output. It is now more than double the annual value of our gold yield. There are 12 plants with an annual output in excess of 14,000,000 barrels.

Granite

Though California is far in the lead among the coast states as a commercial producer of granite, Arizona, Oregon, Idaho, Washington are also important sources, with lesser amounts annually coming from Nevada and Utah. For building purposes, the granites found in California, particularly the varieties from Raymond, in Madera County; Rocklin, in Placer County; and near Porterville, in Tulare County, are unexcelled by any similar stone found elsewhere. The quantities available, notably at Raymond and Porterville, are unlimited.

Lime

Limestone is widely distributed throughout California, and apparently is available in commercial deposits in all of the Pacific coast states, as all except Alaska annually report production. Alaska ships marble, so it too, has the raw material. There are a number of plants which calcine the rock, producing lime which is utilized for structural purposes. Practically any economic specifications can be met as to quality and quantity.

Magnesite

Washington and California are the only commercial contributors of magnesite in the United States thus far. The occurrence of this mineral has been noted in Nevada, and it might be expected in the serpentine areas of southwestern Oregon, but none has been developed. The Washington and California magnesites are quite different, both in character of the mineral itself and the associations of the occurrences. Most of the California magnesite is comparatively pure and is ordinarily a beautiful, white, fine grained rock with a conchoidal fracture resembling a break in porcelain. The most important deposits thus far developed are segregations in or alterations from serpentine, though there are at least two sedimentary deposits. The magnesite of the Washington deposits is fairly coarsely crystalline, resembling dolomite and some crystalline limestones in physical appearance. It occurs interbedded with dolomitic limestone, and its color varies through light to dark gray, and pink. It contains a small percentage of iron, making it particularly suitable for refractory purposes, while the California magnesite is most suitable for plastic uses.

Marble

California and Alaska are both commercial producers of marble, and smaller amounts are contributed by Arizona, Utah and Washington. Alaska has one advantage in transportation in that the marble deposits being worked are at tidewater and the blocks of stone can be loaded directly onto seagoing vessels. The principal variety is white, with more or less black veining. Marble is widely distributed in California, and in a considerable range of color and grain. Many beautiful and serviceable varieties occur, which are suitable for almost any conceivable purpose of construction or

decoration. These also include onyx marble and travertine of beautiful coloring and effects, and serpentine marble suitable for electrical switchboards.

Sandstone

Important amounts of sandstone are quarried annually in Washington, Oregon, Idaho, and California, with some also in Utah and Arizona. The Californian stone is mostly gray, buff, or yellow in color. The popularity of lighter-colored building stones and other finishes, such as architectural terra cotta, has curtailed sandstone production here during recent years.

Slate

California has available supplies of black and gray slate that compare favorably for roofing purposes with those products found elsewhere, and through quiescent for a number of years, there are prospects of it again being on the market soon. Utah has deposits of green and purple slates from which commercial shipments are made. Slates with serviceable possibilities have been noted from Nevada and Arizona, but are undeveloped.

Industrial Materials

The substances designated as "industrial" numerically form quite an imposing total. Many of these substances are mineral earths, or they are minerals that have specific industrial applications. Marketing becomes a more vital part of the problem when handling this type of product than with metallic ores. In some cases rigid trade specifications must be adhered to as to quality and composition. Most of our "industrial" minerals have been largely dependent upon the local and Pacific coast markets, which are restricted by our limited population and fewer industrial plants than the markets for similar ores in the more populous eastern states.

Asbestos

Arizona leads the United States in annual production of asbestos, not only in quantity but in length of fibre of her chrysotile variety and consequent value. Smaller amounts are contributed by California and Idaho, but the total for all three is small in comparison with the Canadian output. Part of the Californian material is amphibole. The future of asbestos mining in California and the other western states is dependent largely upon the development of uses in quantity for the short-fibre mill grades, and for the amphibole variety. Large resources of such material can apparently be made available.

Barytes

About two-thirds of the total tonnage of barytes utilized in the United States is taken in the manufacture of lithopone. The principal sources are Missouri, Georgia, and Tennessee, but commercial amounts are also contributed by California, Arizona, and Nevada. Two plants in California are preparing lithopone or other barium chemicals. One of the newer uses of barite or "heavy spar," as it is sometimes called, is to increase the specific gravity of the heavy mud employed in oil-well drilling operations to hold down gas pressure.

Diatomaceous Earth

The two major uses for diatomite are for filtration and for insulation, the latter both in heating and refrigeration units. It also has important uses as an absorbent and for polishing purposes. Diatomaceous earth is a very light and extremely porous chalk-like material composed of pure silica (chalk being calcareous) which has been laid down under water and consists of the remains of microscopical plants called diatoms. About 75 per cent of the diatomite shipments in the United States come from Santa Barbara County, Calif. Smaller amounts are shipped from Monterey, Los Angeles, and Shasta Counties, and from the states of Nevada, Oregon, and Washington.

Dolomite

Since dolomite, as such, has been found to have distinctive applications, we have, for a number of years in California, been listing it separately in our mineral resources reports; but in the reports of other states and the Federal bureaus it is still included with the limestone data. An important part of the tonnage of dolomite in California is utilized as a refractory lining in the bottoms of open-hearth steel furnaces, as a substitute for magnesite. Calcined dolomite is also used by paper mills, replacing an artificial mixture of calcined limestone and magnesite in the sulphite process of manufacture of paper from wood pulp. The paper mills of Washington and Oregon should provide a market for a considerable tonnage of dolomite, if not already doing so.

Feldspar

Feldspar, which is so important to the ceramic indsutries, is supplied to coast plants largely from quarries in San Diego and Riverside Counties, Calif., and some also from near Kingman, Ariz.

Fluorspar

Fluorspar, of such great value as a flux in the metallurgy of steel and of aluminum, is apparently not being produced commercially by any of the Pacific coast group of states, though small tonnages have, in the past, come from deposits in Arizona, California, Nevada, Utah, and Washington.

Fuller's Earth

Production of fuller's earth is reported from California and Nevada, and is utilized principally in the refining of crude petroleum. Most of the Californian material so used, however, consists of clays of the bentonite class rather than the true fuller's earth. The practical test of a "fuller's

earth" is, after all, not so much a chemical as a physical one; that it, its physical capacity to absorb basic colors and to remove these colors from solution in animal, vegetable, or mineral oils, also from water. Utah reports production under the designation "mineral soap."

Graphite

Graphite has been produced from time to time in California, but not as yet in large amounts. A small output is reported from Nevada. The Nevadan mineral is the amorphous variety, and the Californian, chystalline.

Gypsum

Nevada and California are the two principal western producers of gypsum, with the former considerably in the lead, the important deposits being in Lincoln and Lyon Counties. California's principal sources are Imperial, Riverside, Kern and San Bernardino Counties. Some gypsum also is produced in Arizona, Oregon, Utah, and Alaska. That from Alaska is shipped crude to Tacoma, Wash., where it is calcined.

The most important use of gypsum from the quantity standpoint is in the calcined form, where it is utilized in the manufacture of various hard-wall plasters and plaster board. The portland cement industry is, of course, an important customer for gypsum, 2 per cent by weight being added to the cement clinker just before the final grinding.

Limestone

Limestone has many industrial uses. Under this heading we include the stone used as a smelter and foundry flux, for glass and sugar making, and other special chemical and manufacturing processes. It also includes that used for fertilizers, roofing gravel, concrete filler, whiting for putty, paint, kalsomine and rubber filler, facing dust for concrete pipe, and a host of others. Calcareous marl sold for agricultural purposes is likewise classified under this designation.

From the annual quantity and value standpoint, Utah, California, and Washington are the important producers of the Pacific coast group, in the order named. Smaller quantities are reported from each of the others, except Alaska. Limestone is of widespread occurrence in most of these states, as it is in California, but commercial development is dependent principally upon the economic factor of convenience to cheap transportation, as well as upon chemical analysis and size of deposit.

Phosphates

Idaho is the only state of the Pacific coast group which produces phosphate rock, and it is there an important resource. Some shipments have been made from Utah, but not recently. There have been some occurrences of phosphates noted in California, but as yet no economic development has resulted. It is apparently too low in grade.

Soapstone and Talc

The widest use of talc is in the powdered form, and the value depends upon color (whiteness), uniformity, fineness of grain, freedom from grit, "slip," and sometimes freedom from lime. Nearly 80 per cent of the product in California at present is high-grade talc, mainly from Inyo and San Bernardino Counties, with some also from Shasta, and is utilized mostly in toilet powders, paints, paper, and rubber manufacture, some also in ceramics and for polishing rice. The "soapstone" grades are being used mainly for roofing granules and as a filler in roofing paper, and part also in magnesite cement mixtures. None of the other western states report either talc or soapstone.

Sulphur

Native sulphur is being produced commercially on a moderate scale from a deposit in Humboldt County, Nev. Deposits of native sulphur have been noted at a number of localities in California, but thus far production has been small and irregular. It is difficult for these western deposits to compete with the enormous and cheaply-mined resources of Texas and Louisiana in this element, which are now supplying the important world markets.

Salines

In the borates, California leads, but is joined by Nevada.

Common salt is an important item in California's commercial list, as well as in Utah. In the former, it is obtained mainly by solar evaporation of the Pacific Ocean water, and in the latter from the water of Great Salt Lake.

Potash is an important item in California's list, one plant alone at Searles Lake accounting for approximately 75 per cent of the domestic output in the United States, or nearly $2,000,000 value in 1927. Utah is also a contributor.

Sodium compounds to some extent replace potassium compounds in glass and soap making, in photography, match making, tanning, and in the manufacture of cyanide for extracting gold and silver from their ores. Commercial production in California includes all of the above, joined by Arizona, Nevada, and Washington, with the natural sulphate.

Summary

As evidenced by the foregoing, these states of the Pacific coast group are "well heeled," in the terms of the vernacular, so far as raw mineral resources are concerned, and particularly as regards the nonmetallic ores. Almost any possible line of industry desiring to locate in our midst can be supplied from one or another source within this territory.

Pioneer Sand and Gravel Company Operates Two Complete Plants at Steilacoom, Wash.

Overproduction in Certain Sizes Is Dumped Into Sound by a Cleverly Constructed "Acrobatic Barge."

By FRANCIS CHURCH LINCOLN
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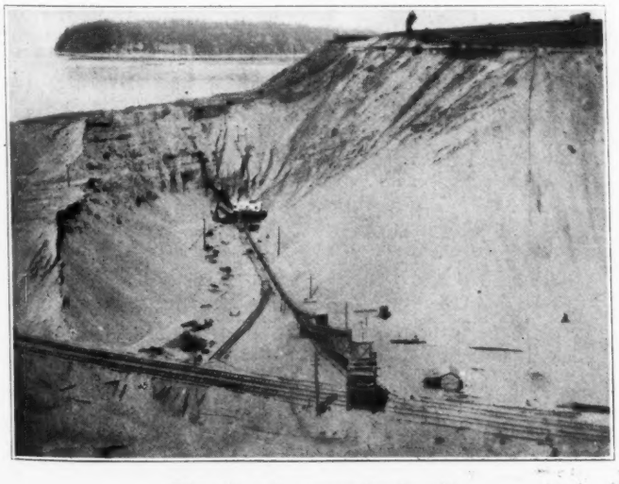
THE Pioneer Sand and Gravel Company of Seattle, Wash., is the largest producer of sand and gravel in the Puget Sound region. Its annual output is in the neighborhood of 1,000,000 cu. yd., and its pits have an actual producing capacity of three or four times that amount. The company also operates a gravel pit and washer at Horton on the Northern Pacific railroad in eastern Montana which produces railroad ballast at the rate of 3,000 cu. yd. a day. In December, the entire interests of the George Scofield Company of Tacoma, Wash., operating a large wholesale and retail sand and gravel plant, and conducting a general building materials business in a modern plant on Dock Street, were taken over by this company. The Scofield Company operated one of the largest and oldest plants in Tacoma, with tidewater, rail and road shipping facilities, and maintained a large building materials warehouse on Lake Union in Seattle. It was Tacoma agents for a line of building materials handled exclusively by the Pioneer company for the past 20 years.

The Pioneer pit is the largest and contributes about 80 per cent of the company's total production. The company owns two other pits on Puget Sound, the Fauntleroy and the Heeney, both mined by the hydraulic method, and a gravel deposit at the mouth of the Cedar River on Lake Washington, which is excavated by dredging with a clamshell bucket. It is located on the shore of Puget Sound, 2½ mi. north of the town of Steilacoom. It is 30 mi. southwest of Seattle and 7 mi. west of Tacoma.



Shovel and conveyors in pit

Washing plant, and storage pile (upper right)

The property has a water front of about 1 mi. and is crossed by two railroads—the Northern Pacific and the Oregon-Washington. Two scow bunkers on the Sound and two rail bunkers and 2 mi. of spur tracks on shore, facilitate shipments by water and by land.

The thickness of the sand and gravel deposit is undetermined, but the face of the Pioneer pit is 235 ft. in height. The deposit is of high quality and was formed in the delta of an ancient river which brought down the material from the moraines of the Nisqually Glacier, which had its source upon Mt. Rainier. The deposit is stratified and some of the strata are cross-bedded. The pebbles and grains of gravel and sand are of hard sedimentary and igneous rocks. Soft rocks like shale and organic matter are lacking, and there are but few boulders. These conditions make it possible to produce sand and gravel of the highest quality at a low cost.

The Pioneer pit was opened about 25 years ago. First mined by the hydraulic method, its output was shipped entirely by scow. Eleven years ago, railroad bunkers were installed and shipments by rail began while scow shipments continued. Two years later a McMyler-Interstate locomotive crane with a 1-cu. yd. bucket was purchased and put into operation, loading pit-run gravel directly into railway cars. This crane is still employed for that purpose.

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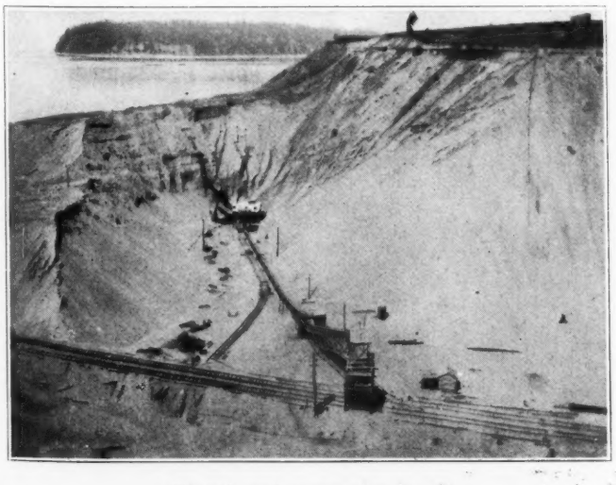

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The thickness of the sand and gravel deposit is undetermined, but the face of the Pioneer pit is 235 ft. in height. The deposit is of high quality and was formed in the delta of an ancient river which brought down the material from the moraines of the Nisqually Glacier, which had its source upon Mt. Rainier. The deposit is stratified and some of the strata are cross-bedded. The pebbles and grains of gravel and sand are of hard sedimentary and igneous rocks. Soft rocks like shale and organic matter are lacking, and there are but few boulders. These conditions make it possible to produce sand and gravel of the highest quality at a low cost.

The Pioneer pit was opened about 25 years ago. First mined by the hydraulic method, its output was shipped entirely by scow. Eleven years ago, railroad bunkers were installed and shipments by rail began while scow shipments continued. Two years later a McMyler-Interstate locomotive crane with a 1-cu. yd. bucket was purchased and put into operation, loading pit-run gravel directly into railway cars. This crane is still employed for that purpose.

The elevation of gravel to a storage pile above the washers and bunkers did not begin until six

years ago, when a 65-ton steam shovel, with a 2½-cu. yd. dipper, was procured for this work. This shovel loaded directly into 10-cu. yd. quarry cars on an incline. These cars were alternately and independently hauled to the top of the incline and dumped from a trestle upon the stock pile. This system had a capacity of 250 cu. yd. per hour. In 1926, the steam shovel was replaced by a Marion electric shovel. Hoppers and a belt conveyor were installed and larger quarry cars were run in balance, which increased the capacity of the elevating system to 400 cu. yd. per hr. This change in method of excavation and elevation was described in PIT AND QUARRY for September 29, 1926. Since that time, the system has been extended by the addition of a second belt conveyor and another hopper, as will be described.

Self-dumping car at top of incline. Note streams of water moving material into and through the sluice-boxes

Hydraulicking

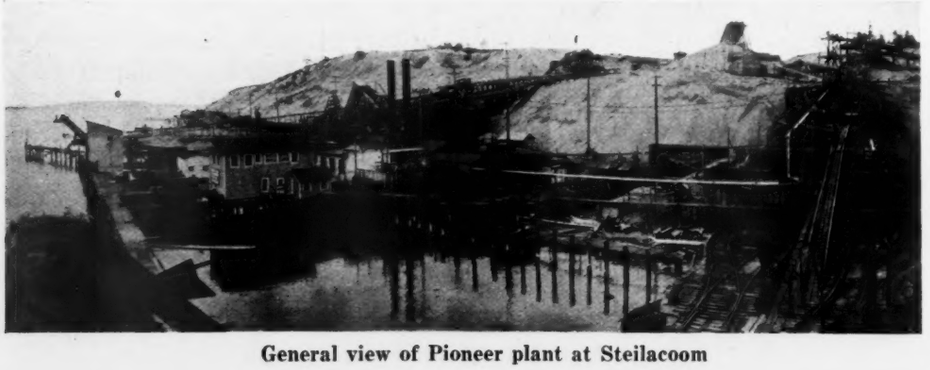
The sand and gravel are loosened by water under pressure and washed down the 235-ft. pit face. Salt water is employed both for loosening the gravel in excavating and for sluicing the excavated material from the storage pile to the washers. All the pipe is galvanized, both riveted and welded types being used. It was purchased from the Hydraulic Supply Company of Seattle. The water for use in hydraulicking is pumped to the top of the pit bank, through a 6-in. pipe, by a 3½-in. two-stage Moran centrifugal pump, having a capacity of 250 g.p.m., and driven by a 40-hp. motor.

The shovel on the pit floor is a Marion electric, equipped with a 3½-cu. yd. dipper, a 30-ft. dipper arm, and a 45-ft. boom. The shovel has a full swing, capable of cleaning up 34 ft. at grade and dumping 54 ft. from the center. It moves on caterpillar treads and has Ward-Leonard control. This shovel delivers the washed-down sand and gravel to a 20-cu. yd steel receiving hopper, built by the Star Iron and Steel Works of Tacoma.

Looking down the incline into the pit

A 6-ft. belt-feeder, driven by a 5-hp. General Electric motor, feeds the material from the receiving hopper to a 30-in. Robins belt conveyor. The conveyor belt, furnished by the Hewitt Gutta Percha & Rubber Manufacturing Company, is a 6-ply and has a 5/32-in. cover with breaker strip and a 1/16-in. bottom. It is driven by a 40-hp. General Electric motor through a Jones speed reducer supported by a steel unit made up of 30-ft. truss sections, at present over 500 ft. in length. This supporting device was designed by Charles M. Rudow of Chicago and the first unit was built by the Wallace Bridge and Structural Steel Company of Seattle. As the shovel advances, this unit will be extended in 30-ft. sections until a total length of 400 ft. is reached. Then a unit will be installed and a new belt and truss system of extension will be begun. This second unit has already been built by the Isaacson Iron Works of Seattle.

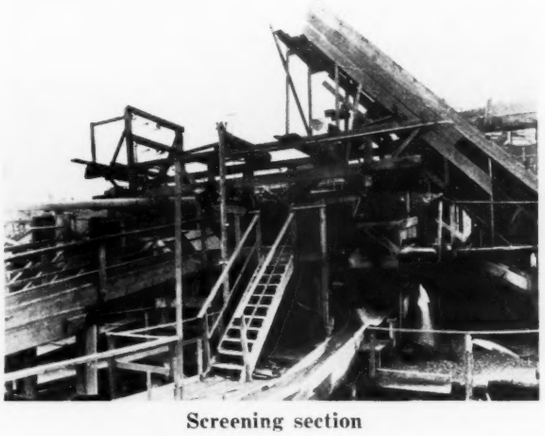
The first belt conveyor delivers its load to a second 30-in. Gutta Percha conveying belt, similar to the first, but with only 1/32-in. bottom cover, mounted on a 120-ft. Star steel truss and driven by a 40-hp. General Electric motor. This elevates the material to a 40-cu. yd. Star steel discharge hopper. The discharge hopper straddles the double track of a 700-ft. incline, upon which run two 13-cu. yd. side-dump cars, made by the Pacific Coast and Foundry Works. The cars are attached to ⅞-in. Broderick and Bascom Yellow Strand cables and are operated in balance by a 200-hp. 2-drum reversible electric hoist which was supplied by the Washington Iron Works. Each car loads itself from the discharge hopper at the bottom of



General view of Pioneer plant at Steilacoom

the incline and is hauled up the incline at the top of which it dumps automatically upon the storage pile. The hoppers in the transportation system introduce a desirable element of flexibility between shovel and cars. The capacity of the installation is 400 cu. yd. per hr.

The storage pile is located upon a bank above the two gravel washing plants. The pit-run gravel in the storage pile is reclaimed hydraulically and transported to the washing plants through sluices. The water used to load the sluices, and to transport and wash the gravel, is supplied by three pumps and a system of pipe lines. A Cameron 2-stage centrifugal pump, driven by a 300-hp. General Electric motor, has a capacity of 5,800 g.p.m. and furnishes water to the main pipe-line which is 24 in. in diameter. A DeLaval single-stage centrifugal pump, driven by a 150-hp. General Electric motor and having a capacity of 2,700 g.p.m., supplies water to a 14-in. pipe-line which is connected with the main 24-in. line. A booster pump, furnished by the Moran Manufacturing Company, Seattle, is

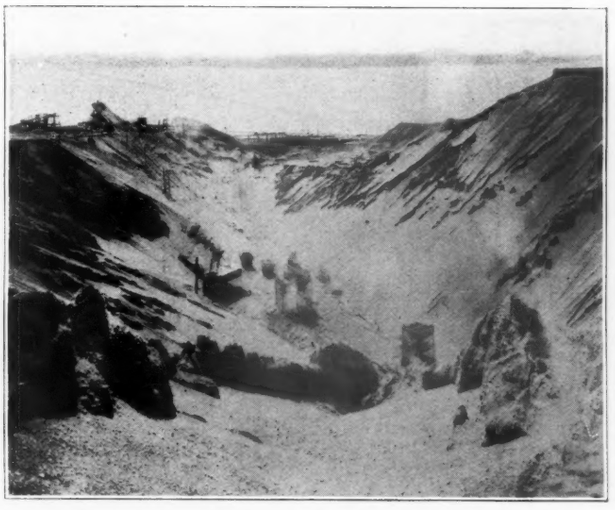


Screening section

used to increase the pressure at the end of the main line. A 40-hp. General Electric motor drives the booster pump. Fire hose, 2½-in. in diameter, is employed to distribute the water used in hydraulicking the pit-run gravel into the sluices. There are five of these sluices, two going to No. 1 washer and three to the No. 2 washer. Each sluice is 14 in. in width, has a slope of 12½ per cent, and is lined with chrome steel plate ½-in. thick. This lining lasts about a year, some 50 tons of chrome steel being consumed annually. One sluice was lined with rubber as an experiment but, while the rubber lining wore better than the steel lining, other factors made its adoption in this particular installation undesirable.

The Washers

The gravel washers are similar in many respects except that No. 2 has 50 per cent greater capacity than No. 1. Each washer is equipped with railroad bunkers situated beside the railroad tracks near



Looking toward Puget Sound from head of pit

the storage pile, and with scow bunkers located on the shore of Puget Sound. In each plant, washing is done both above the railroad bunkers and above the scow bunkers.

Over the railroad bunkers, coarse sizing is performed by grizzlies and fixed screens, and fine sizing by vibrating screens, the sizes of the various screens being changed to suit requirements. The grizzlies employed in the railroad sluices are constructed of six 6-ft. rods of carbon steel 1-in. square, set 2 in. apart at their upper ends and 2½ in. apart at their lower ends to prevent blinding by wedging of particles. There are no crushers at the railroad bunkers, so the oversize from the railroad grizzlies is discharged into the scow bunkers. Tyloy screen cloth, made by the W. S. Tyler Company, is used for the fixed screens. A 4-ft. by 5-ft. Type 39 Hum-mer electric vibrating screen, with two screening surfaces, treats the fine sizes at the No. 1 washer, while a 4-ft. by 7-ft. Leahy mechanical vibrating screen with two screening surfaces and driven by a 1-hp. motor, serves the same purpose at the No. 2 washer. The railroad bunkers have a combined capacity of 3,000 cu. yd. in an 8-hour day.

At the scow bunkers of both washers, the sand and gravel are first screened on flat sand screens

Shovels, hoppers, and the two cars at foot of the incline

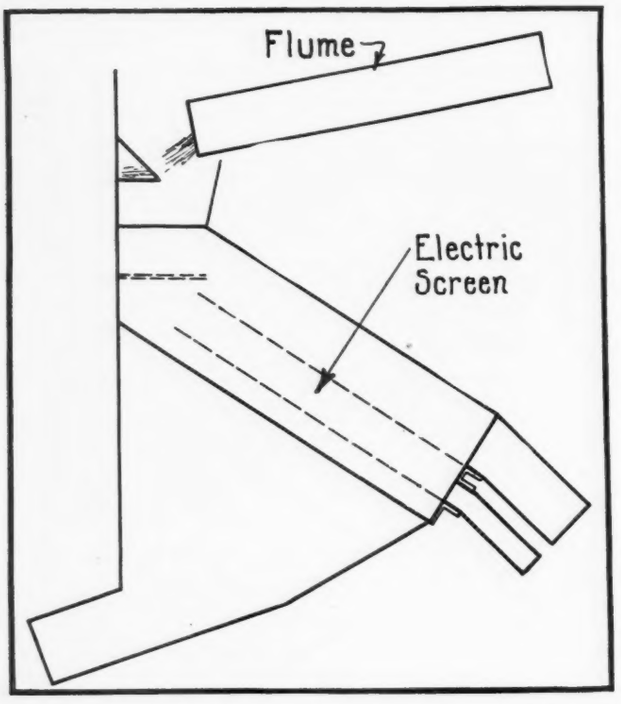


Diagram showing flow of water to material passing over vibrating screen

set in the bottoms of the sluices. Next come revolving grizzlies whose oversize is crushed and returned by bucket elevators to the sluices below the grizzlies. There are two revolving grizzlies at No. 1 scow bunkers and three at No. 2. The grizzlies were made by the Washington Iron Works of Seattle. They are conical in shape, 6½ ft. in length, 3 ft. in diameter at the smaller end, and 4 ft. in diameter at the large end. Bars are of manganese steel and were supplied by the Electric Steel Foundry Company of Portland, Ore. The bars are spaced 2 in. apart and have lugs projecting from one side at 3-in. intervals, making the grizzly openings 2-in. by 3-in. rectangles.

At the No. 1 washer the oversize from the grizzlies is crushed by a Traylor gyratory crusher and the crushed material returned up to the sluice by a bucket elevator; while at No. 2 washer the procedure is similar except that the crushing is done by an Aurora jaw crusher. The undersize from the grizzlies is sized on fixed screens. It collects in a sluice, at the end of which is a deflector in the form of a wedge in the bottom, which causes the material to be thrown upward against a sand screen set at 65 deg., through which the fine sand and water pass, the gravel falling upon a 45 deg. gravel screen across which the oversize passes to hip plates which divide it and pass it over two sets of gravity screens. The use of flat sand screens, revolving grizzlies, and deflectors results in a considerable saving in washer head without loss in screening efficiency. By this process three grades of gravel are produced: roofing, coarse, and fine. The capacity of the scow bunkers is about the same as that of the railroad bunkers—3,000 cu. yd. in 8 hours.

Under the system described, there was a considerable waste of coarse gravel. This has been eliminated by the new crushing and screening equipment installed at the discharge end of the conveying system. Two heavy duty Traylor vibrating screens are arranged in series and pass 1½-in. material. The conveying system has a capacity of 400 cu. yd. per hr., all of which goes to the screens. The oversize, which is rejected at the rate of about 180 tons per hr., goes to the new 4-ft. Symons cone crusher, which reduces the oversize from the screens to fragments of less than 1½ in. in diameter.

The Fleet

The Pioneer company's fleet consists of 12 scows and 5 tugs, and other vessels are hired during the busy season. The capacities of the scows vary from 450 cu. yd. to 750 cu. yd. They are loaded from the scow bunkers with the aid of two 100-hp. Lambert steam hoists equipped with ¾-in. Yellow Strand wire rope. Large quantities of oversize and fines, which are not in immediate demand, are disposed of by dumping into the Sound.

Self-Dumping Barge

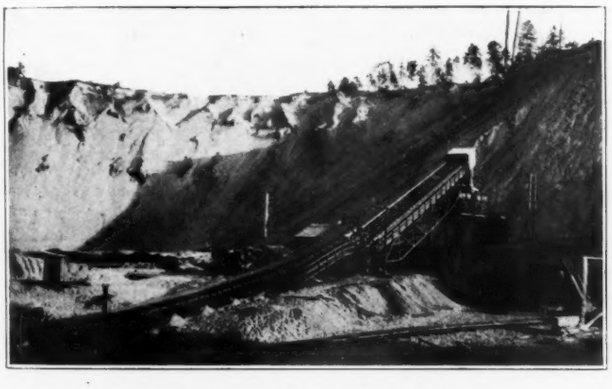
This is accomplished by means of an ingenious dump scow invented by Phil Vincent. This scow was aptly called the "acrobatic barge" by *The Yellow Strand,* house-organ of the Broderick and Bascom Rope Company, in a description published in the May, 1929 issue. President H. F. Ostrander of the Pioneer Sand and Gravel Company acquired the patent rights to the "acrobatic scow" and developed it.

The scow is of wood construction 100 ft. long, 36 ft. wide and 11½ ft. deep. Top and bottom sections are reversible and exactly alike, each being provided with sideboards to hold gravel. A vertical partition runs lengthwise through the body of the scow, dividing it into two equal halves. A horizontal partition divides each half into a small

Swinging truss receives material from electric shovel and delivers into cars on inclined tramway

water-tight air compartment and a larger water flood-tank, these air and water compartments being reversed in position on opposite sides of the scow. On each side of the central vertical partition is a 16-in. pipe extending through the scow from deck to deck and open at both ends. These pipes are provided with two 8-in. ports controlled by gates, located at the top and bottom of the water flood-chambers. These ports or valves serve to admit or drain off the water from these chambers.

The operation of the dump scow is simple. With both water chambers filled with air and the valves closed, a load of 550 cu. yd. of waste material is placed upon the deck and the scow is towed to a point ½ mi. from shore, where the water is from 700 ft. to 800 ft. deep. The valves, on that side of the scow where the water chamber is below the air chamber, are then opened by means of a trip rope from the towing tug. The flood-tank on that side of the scow then fills with water until the increased weight on that side throws the load out of balance, the scow turning upside down and dumping its load into the water, bringing the deck previously sub-



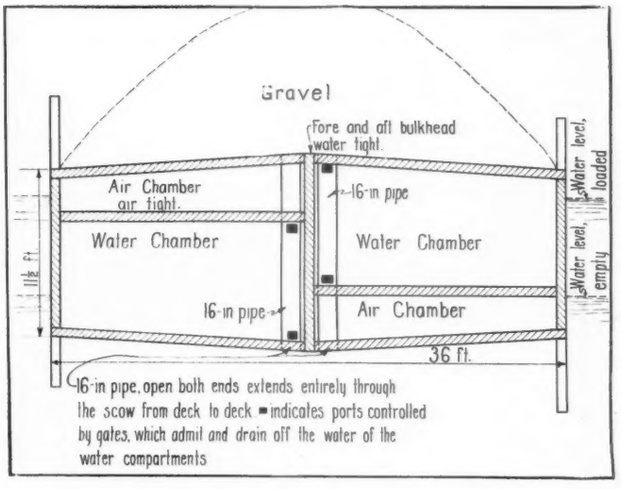
Conveyors to hopper which feeds the two dump cars that traverse the incline to the plant

merged to the top. The water compartment with its flood-valves open is now above the air compartment on that side; and, since the load has been removed the buoyancy of the half of the barge filled with air and of the air chamber beneath the compartment filled with water, is sufficient to lift the scow until all the water drains out and the water compartment is above the water line.

Meanwhile, the scow is being towed back to dock. Upon arrival, drainage is complete, and it is only necessary to give a lever a quarter turn to close the valves, when the scow is ready for loading again. It is interesting to note that this type of dump scow is now in use disposing of 5,000,000 cu. yd. of dirt which is being excavated in a re-grading project in Seattle.

The Laboratory

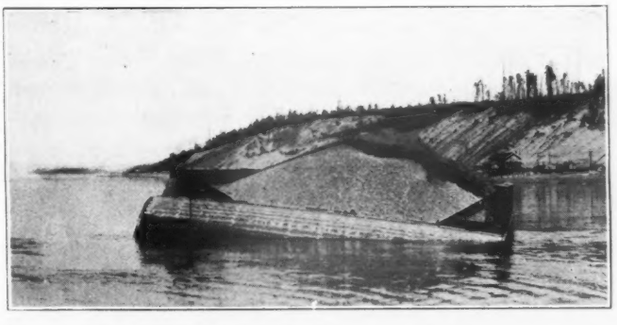
The Pioneer company maintains a testing laboratory at its Pioneer pit in order to meet the requirements of grading for its products, which are


Gravel
Fore and aft bulkhead water tight.
Air Chamber air tight.
16-in pipe
Water Chamber
Water Chamber
Water level, loaded
Water level, empty
11½ ft.
16-in pipe
Air Chamber
36 ft.
16-in pipe, open both ends extends entirely through the scow from deck to deck = indicates ports controlled by gates, which admit and drain off the water of the water compartments

Diagrammatic section of overturning barge

becoming more definite and exacting each year. This laboratory is provided with Tyler testing sieves, a Ro-Tap sieve shaker and other equipment. It contains one item of special interest—a gravel shaker manufactured by the Isaacson Iron Works of Seattle. This is a shaking screen 18½ ft. in length by 1½ ft. in width, driven by a 3-hp. motor. It is provided with screens of all sizes from ¼ in. to 3 in. with both round and square mesh.

Originally it had but one screening surface along which the various sizes of screens were attached in series beginning with the smallest. This made it necessary to take off all the screen plates when changing from round holes to square holes, and vice versa. It has now been equipped with two screening surfaces, the upper being made up of screens with round holes and the lower of screens with square mesh. When it is desired to test material for a square-mesh specification, the first top screen is removed and the gravel fed directly on to the lower set of screens. When testing for a round-hole specification, it is not necessary to make any changes, for what passes the round holes of a given diameter will more readily pass the square. So this arrangement does away with the necessity of changing screens save when some special sizing is desired. For example, the U. S. Reclamation Service, which is one of the company's important accounts, requires sizing on screens with square holes; while the Washington State Highway Com-



Scow or barge starting to overturn

Barge half-way overturned and dumping a load

mission, another quantity buyer, requires that it be done on round holes. When screening for Highway Commission tests, the material is fed upon the upper screening surface and falls through it and the lower surface into the proper trays below; while when test-screening for the Reclamation Service, the material is fed upon the lower surface of the shaking screen and drops directly into the proper trays.

Products

The two plants produce gravel of all sizes, from ⅛ in. up to 3 in., the 1¼-in., 1½-in., and 3-in. sizes being in greatest demand. Paving, building, engine, plaster, and filter sands are sold—the first two being in greatest demand. The total daily capacity of all bunkers is 6,000 cu. yd. and as much as 150,000 cu. yd. have been handled at the Pioneer pit in a single month. About 75 per cent of the production is shipped by water within a 125-mi. radius, the remaining 25 per cent going by rail to users within 60 mi. of the pit.

The Pioneer pit operates continuously throughout the year. Shifts are of 8 and 10 hours. A total of 20 to 45 men are employed. Double shifts are worked occasionally during the busy season. All electric power is purchased from the Puget Sound Light and Power Company.

Plans have been completed on an entirely new bunker for the Pioneer pit. This bunker will concentrate all the screening and loading operations at one point. The new bunker will have a capacity of 25,000 cu. yd., with additional storage facilities for 50,000 cy. yd., and will be equipped throughout with the most efficient modern machinery obtainable.

H. F. Ostrander is president of the Pioneer Sand and Gravel Company and D. L. Williams is vice-president and manager. These men have been connected with the company since its inception. Paul Jarvis is general superintendent in charge of all the company's pits with headquarters at the Pioneer pit. He has been with the company for 10 years. H. R. Mills, assistant superintendent, has been in the employ of the company for 8 years.

Development of Wallboard

Many, of an inventive turn of mind, have devoted their energies during the last several years to the production of a wallboard, or interior lining, which would do away with the dirt and the necessity of waiting for ordinary plaster to dry, says *Asbestos*.

First came the purely utilitarian boards, which were designed simply to replace plaster and had to be papered, painted or otherwise decorated.

Later it seemed certain that the sale of wallboards could be greatly increased if they could be delivered to the user already decorated, as this would save time, and make certain a really good finish.

Then came what we will term "waltile." This is made by the several manufacturers of asbestos cement materials, and sold under various trade names, but basically, it is a flat sheet of asbestos cement, either plain or scored to resemble tile, and then finished by a painting process either in plain colors like tiling, or in some cases in wood or marble finishes.

Clay Industry to Organize a Trade Association

Clay-mining companies, including importers and jobbers, are about to organize a trade association in that industry. The organization is well under way, and it will be completed probably within the next few weeks, as practically all of the clay-mining companies thus far approached are strongly enthusiastic for the proposition.

There are over one hundred different types of clays produced and used in as many different products, such as fine china, porcelain, terra cotta, fire clay products, chemical retorts, bathtubs and all ceramic wares. Clays are used also for coating paper and as a paper filler, in the manufacture of paints, asbestos products, rubber tires, heels and soles and many other rubber products, cement, print goods, window shades, roofing, graphite crucibles, glass and glass melting pots, wall plaster and many gypsum products, as well as many other products of great importance.

It is felt that there are many ways both producer and consumer can work together to their mutual benefit as a result of proper organization. It is planned to give careful study to the standardization of different classes of clay, to carry on research in an effort to improve the quality, and to find new markets for the clay as well as for all products in which clay can be used.

W. J. Parker of New York, who organized the Feldspar Grinders' Institute, is aiding in forming the clay association. For any additional information, communicate directly with him at 7 East 44th Street, New York.

New Quarry and Plant Near Orofino, Idaho, Prepares Crushed and Pulverized Limestone

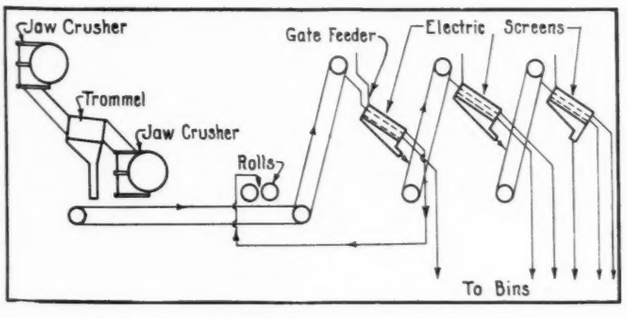
Clearwater Lime Products Company Will Produce Also Lime and Fertilizer

THE new limestone quarry and plant of the Clearwater Lime Products Company are situated on the south fork of the Clearwater River, 2½ miles south from Orofino, the county seat of Clearwater County, Idaho. Orofino is a town of under one thousand population lying on the east bank of the river at an elevation of 1,027 feet above sea-level. It is 39 miles east of the city of Lewiston on the Camas Prairie Railroad, a line which is operated jointly by the Northern Pacific and the Oregon-Washington Railroads. This railway runs up the south fork of the Clearwater River beyond Orofino, past the plant of the Clearwater Lime Products Company, affording it excellent shipping facilities. Highway conditions are not so favorable, the road to Lewiston being in many places narrow, precipitous, and rough; but improvements are promised. Quarry and plant are located upon the Nez Perce Indian reservation and the ground is leased from the federal government.

Historical

Clearwater County is better known for its gold and its lumber than for its limestone. Orofino, indeed, means "pure gold" in Spanish. It was the name applied by Captain Pierce to the creek in which he and his party found placer gold when they came to Idaho from California in 1860, and it was later adopted by the nearby town which grew up. The limestone industry, however, is by no means a new one, it having been initiated with the advent of the railroad about twenty years ago and it has continued intermittently since that time. The old quarry and the lime plant were located upon the river bank about a mile nearer Orofino than the new quarry and limestone plant. Lime was being produced at the old plant when Lupton[1] studied the local geology in 1915.

[1] Lupton, C. T., "The Orofino Coalfield, Clearwater, Lewis and Idaho Counties, Idaho," Bull. 621, U. S. Geological Survey (1915), 101-3.



Flowsheet, crushing section of limestone plant

Clearing ground, lower left, for kilns

The Clearwater Lime Products Company was organized in 1927 through the efforts of the Harr Brothers. The officers are: Walter Harr, president; Elmer Harr, vice-president; Grover Burford, secretary-treasurer; and Dr. F. A. Bryant and Dr. L. C. Kinzie, directors. This company operated the old limestone quarry for a year in order to establish markets. The old plant was then dismantled, such machinery as could be used being moved to the new site; and the new quarry was opened, and the new plant built. The new plant began shipping in May, 1929.

Geology

The limestone deposits on the south fork of the Clearwater River are lenses of coarse, white, crystalline limestone in Algonkian schist. They were first mentioned by Lindgren[2], who stated that the limestone occurred in well-defined beds 120 ft. wide; and later described by Lupton. Locally these lenses strike a little east of north and dip steeply eastward. Three parallel deposits occur upon the hill to the east of the new limestone plant. The first and lowest of these is just across the road from the plant and has been quarried to a slight extent. It is 20 ft. wide at this point and can be traced northward 4,200 ft. to the old limestone quarry, where it widens to 100 ft. The second lens is 30 ft. in width and exposed for 700 ft., but it has not been worked. The third and highest deposit is about one-quarter mile up the hill from the plant and is the one chiefly quarried. This

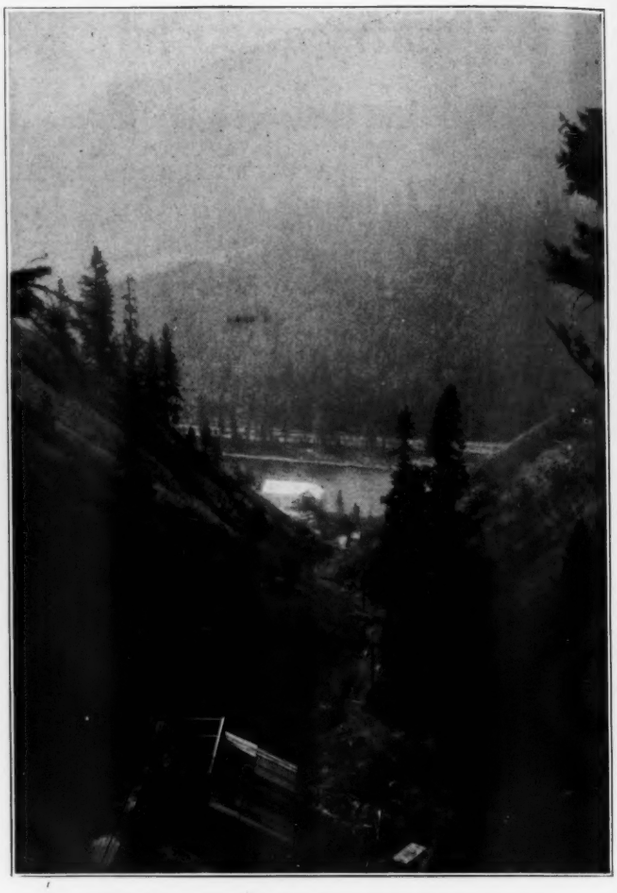
[2] Lindgren, W., "A Geological Reconnaissance Across Bitterroot Range and Clearwater Mountains in Montana and Idaho," Professional Paper 27, U. S. Geological Survey (1904), p. 71.

Limestone plant, looking east across the river

deposit consists of a series of closely spaced limestone lenses which outcrop over an area about 1,000 ft. in width by 2,000 ft. in length. The limestone is very pure, shipments having shown calcium carbonate contents of from 97 per cent to 99 per cent.

Quarrying

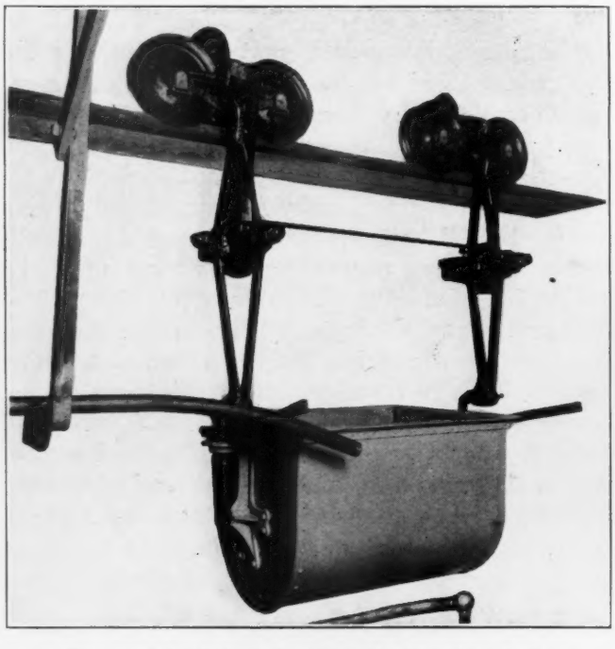
The large upper deposit of limestone is being opened by means of a tunnel run through the footwall schist into the limestone. This tunnel is timbered 6 ft. by 7 ft. in the clear and has a present length of over 150 ft. It passes through one lens of limestone 25 ft. in thickness and enters another which is known from surface work to have a thickness of about 75 ft. and to be followed at a short distance by a still thicker lens. Glory-holes will



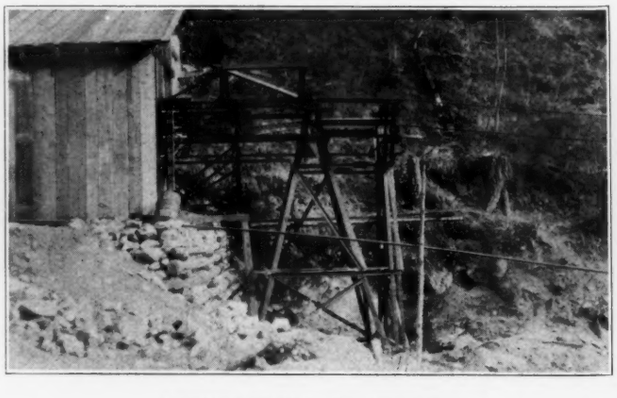
View from main quarry of tramway loading station (foreground) and plant

be opened above the tunnel, which is expected eventually to develop backs of over 500 ft. of limestone.

The compressed air used for drilling both at this quarry and at that on the lowest limestone deposit near the plant is supplied by a Gardner-Denver 8-in. by 6-in. vertical duplex air compressor driven by a 30-hp. Century electric motor. A 2½-ft. by 6-ft. air receiver made by the Union Iron Works of Spokane is used for storage. Blasting is performed with 40 per cent Dupont Special gelatin dynamite which is fired with No. 6 caps and fuse. The limestone broken in the upper quarry is trammed by hand to the loading bins of an aerial



Tramway bucket, and automatic dumping device



Loading station for tramway

Glimpse of lower quarry

tramway which transports it to the plant below. The quarry car employed is a home-made one of the side-dump type and a capacity of 3,000 lb.

Aerial Tramway

There are three loading bins, each 11 ft. by 16 ft. at the top and 16 ft. in depth on a 45-deg. slope. These bins are lined with steel which formerly composed a jail. The aerial tramway was purchased from the Riblet Tramway Company of Spokane, Wash. It is 1,200 ft. in length and has a 220-ft. drop. Each bucket has a capacity of 1,000 lb., and five are employed on the line. The speed of the tramway is regulated by a Century 5-hp. electric motor, which is sometimes pulling

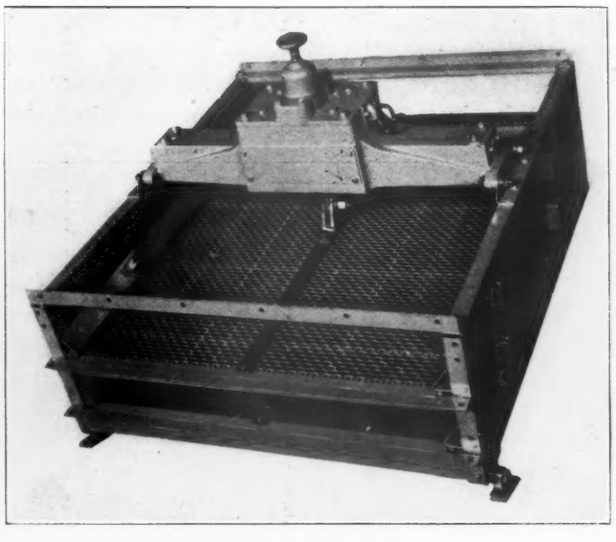
Series of towers at change of slope in aerial tramway

Discharge station of aerial tramway

and sometimes braking. The tramway has a capacity of 360 tons in 24 hr. It dumps into any one of four receiving bins at the plant, the discharge being regulated by an automatic dumper. The first bin is for rock to be burned and has a capacity of 100 tons; the second bin is for rock to be ground and has the same capacity; the third bin is for rock for the paper trade and other large crude rock and has a capacity of 300 tons; while the fourth bin is for spalls for steel mills. The latter bin is on the side of the plant toward the railroad, and from it limestone may be drawn through three bin-gates into railway cars on a spur.

Limestone Plant

Limestone which is to be ground is drawn from the bin through a gate and fed to a 12-in. by 18-in. Good Roads jaw crusher. The crushed product passes to a home-made cylindrical scalping screen 30 in. in diameter by 4 ft. long, perforated with 1-in. round holes, which delivers its oversize to a 4-in. by 8-in. Dodge crusher supplied by Hallade Company, Spokane. The undersize from the scalping screen and the jaw-crusher product are raised together by a 40-ft. company-built bucket elevator which feeds them to the first vibrating screen.



Closeup of vibrating screen

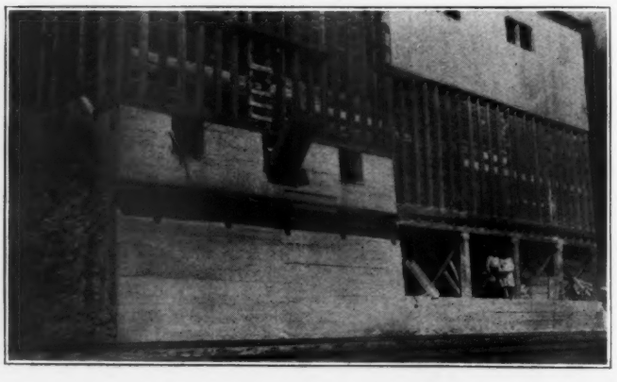
Limestone plant viewed from point on aerial tramway

There are three 3-ft. type 27 Hum-mer electric vibrating screens in this section of the plant, and each is provided with two screening surfaces. The upper surface on the first screen has ¼-in. perforations and the lower has 15/64-in. mesh. It makes but one finished product—a coarse poultry grit known as "turkey grit" which is from 15/64-in. to ¼-in. in diameter.

The oversize from this screen falls to a pair of 20-in. by 24-in. Union Iron Works crushing rolls. The rolls product falls to the same bucket elevator which raises the Dodge-crusher and the scalping-screen product to the first vibrating screen, which is thereby placed in closed circuit with these rolls. The undersize from the first vibrating screen is raised by a short bucket elevator to the second Hum-mer, which has its screening surfaces fitted with wire cloths of 3/16-in. and ⅛-in. diameter openings, respectively.

This second screen makes two finished products, the oversize from the upper screening surface being coarse poultry grit, and that from the lower surface medium poultry grit. The undersize from this screen is raised by another short bucket elevator to the third vibrating screen, which is equipped with 10-mesh and 65-mesh screening surfaces and makes three finished products—fine poultry grit known as baby grit, limestone sand, and limestone flour.

Electric current for the three Hum-mer screens is provided by a 3-hp. motor generator. The three bucket elevators are driven by a 5-hp. Century electric motor. The remainder of the machinery is driven by a 35½-hp. General Electric motor. Storage for the ground products is provided by eight 100-ton bins.



Loading facilities on west side of the plant

Installations in Progress

In order to supply the growing demand for finely pulverized limestone, a 4-ft. by 3-ft. ball mill using balls 2-in. and 2½-in. in diameter has been purchased from the Union Iron Works and will be driven by a 30-hp. motor. Its product will be raised by a 28-ft. home-made bucket elevator to a fourth Hum-mer electric vibrating screen provided with a 100-mesh screening surface. This ball-mill section will be housed in an addition 32 ft. by 40 ft. provided with three bins and will be run as an independent unit.

Tunnel in main quarry

A ventilating system will remove the fine limestone dust from the plant. A mixer will incorporate sulphur with limestone flour to produce a fertilizer. Two 12½-ton lime kilns are to be erected beside the limestone plant and supplied with crude limestone from the first of the aerial tramway bins. These kilns were built by the Steacy-Schmidt Company of York, Pa.—a subsidiary of the Hardinge Company. Wood will be used as kiln fuel and a contract has been made with the Clearwater Timber Company to supply it. The cost of the entire plant on this property, when completed, will be approximately $100,000.

(*Continued on Page 73*)

Gravel Ballast for Railroad Purposes*

By DANIEL HUBBARD,
Division Engineer, The Chesapeake and Ohio Railway Company

IN THE Manual of the American Railway Engineering Association, gravel ballast is subdivided between three headings, i. e., washed gravel, screened gravel and pit run gravel. It has been proposed by the Ballast Committee of the American Railway Engineering Association to reduce this to only two sub-headings—namely, prepared gravel and pit run gravel—which we felt would be much more appropriate and which would simplify the explanation of gravel's use for railroad purposes. Prepared gravel will be any gravel which is crushed, washed or screened to meet A. R. E. A. specifications for such ballast. Pit run ballast will be that ballast which comes direct from the pit without any further preparation.

I wish to quote a few instances of the use of gravel under track which supports exceptionally heavy tonnage. A short time ago there was turned over to me a line which had been ballasted entirely with pit run gravel. This aggregate was from twelve inches to four feet in depth on a double track railroad, sixty-three miles long, and which had been completed in a comparatively short time. The heavy traffic was west bound. A short time after taking over this stretch of track for maintenance, pumping joints and pumping track developed on the west bound track, while the east bound still held up in good condition. After a study of local conditions it was decided to reballast the entire west bound track with prepared gravel with an average of 3 in. lift. Before the application of the prepared gravel, the pit run was in some instances put under with a light raise, and where roadbed conditions warranted was cast aside and used as roadbed material.

After this application, in one season, of sixty-three miles of prepared gravel ballast, the pumping joints and track almost entirely disappeared. The east bound, sixty-three miles, which carried the light traffic, we were able to hold for another year on pit run gravel with very light renewals, with the exception of such replacements as were necessary on the new fills which were settling. In view of the success that we had on the west bound, it was later decided to give the east bound track the same treatment as previously given the west bound.

The results have been more than satisfactory. Pumping joints on both tracks have practically disappeared, due to the fact that the second lift had been made on good clean gravel ballast. It is not to be considered that this three-inch raise is going to hold up, under the heavy traffic carried, indefinitely; and with the view of obtaining better riding track and less maintenance labor cost, it has now been decided to give both tracks a further lift on prepared gravel. This means a very heavy maintenance budget for the mileage involved for the ensuing year, but the results obtained, I am sure, will more than compensate for this cost.

In connection with the use of by-products from gravel plants, I would like to call your attention to the possible use of sand, especially in localities where this product is not easily assimilated by the highway construction program. For railroad purposes—especially in connection with sub-division of grades, where, as a general rule, tracks are raised and highways are lowered—this material has been very extensively and successfully used for raising main line tracks anywhere from three to twenty feet. In a great measure its success has been due to the fact that on fills where track is raised on sand, there is very little shrinkage.

I do not know of very many railroads which have adopted this mode of procedure, but the thought occurs to me that it is one well worthy of consideration by all gravel ballast people whose excessive sand is not easily disposed of. I know from personal observation that it has been a very decided success on one railroad, the use of which resulted in a very material saving on construction cost, where tracks were raised in elimination of grade crossings. One of the most important features in connection with this class of work is the non-obstruction of traffic and cheapness of the material available. A great many of you, no doubt, have a very serious proposition on your hands as to how to obtain a profitable market for such a by-product, and if this method of obtaining successful results was used on one railroad, certainly it could be applied to practically every railroad in the country, within a reasonable distance of ballast pits, where work of this kind is contemplated.

I had expected at this meeting to give you some comparative data as between the cost of maintenance, under heavy traffic conditions, of gravel and stone ballast. I regret to say that this study has not yet been completed, and therefore the figures at present would not be of much value. Suffice to say that on one hundred and twenty-three miles of double track, under exceedingly heavy traffic and high speed passenger traffic, it has been decided in the last few years to go entirely to prepared gravel ballast, which so far has proved beneficial beyond expectations. The maintenance cost has been re-

(Continued on Page 73)

*Paper read before the National Sand and Gravel Convention at Memphis, Jan. 30, 1930.

American Concrete Institute Discusses Numerous Practical and Technical Problems

THE 26th annual convention of the American Concrete Institute, held February 11-13, 1930, at New Orleans, La., had a registration of 275, and each of the five scheduled sessions was well attended. Recreation was interspersed with the sessions. There were fewer stated papers than have usually been scheduled.

Among the topics to receive special consideration were ready-mixed concrete, cement variability, industrial floor finishes, pavement curing, and specification for structural concrete.

E. D. Boyer, retiring president of two years' service, reviewed the development of concrete and presented a brilliant future for it. The Institute has for its new president a man whose researches in concrete have done much to bring about the present universal use of this material—Duff A. Abrams.

The Wason medal, for the most meritorious paper presented at the preceding convention, was awarded to L. G. Lenhardt, of Detroit's Department of Water Supply. His paper was "The Concrete Lining of the Detroit Water Tunnels."

Duplicates of the Wason research medal were awarded to H. F. Gonnerman and P. M. Woodworth, both of the Portland Cement Association, for their joint preparation of a paper entitled "Tests of Retempered Concrete."

The Henry C. Turner gold medal went to Dean F. E. Turneaure, College of Mechanics and Engineering, University of Wisconsin, "for distinguished service in formulating sound principles of reinforced-concrete design."

Arthur R. Lord presented a set of specifications to regulate concrete work on ordinary buildings. These included the determination of strength from preliminary tests on a water-cement ratio basis; and the requirements (1) that cement be held in sealed storage until seven-day tests can be completed, and (2) that a supply of all materials be maintained constantly on each job.

William F. Zabriskie similarly presented specifications covering fabricating and setting reinforcing steel. He also presented a non-technical discussion of the theory of the proper positions for reinforcing steel.

Ready-Mixed Concrete

One subject that held special interest was ready-mixed concrete. The discussions covered both the centrally-mixed and the mixed-in-transit practices. Among the topics suggested for specifications were the following:

The operation of every central plant shall be under the direct supervision of a competent testing engineer. Each load of concrete shall be accompanied by a certified statement of the quantities of the ingredients and the quality of the concrete.

One specimen test must be made for every 50 cu. yd. of concrete placed.

Flat-bottom trucks shall not be used to transport concrete if wetter than a 2½-in.-slump.

For wet concrete, agitator bodies shall be required.

Mixed concrete shall not be transported more than one hour after addition of the cement.

For concrete proportioned in a central plant but mixed on the truck, the following stipulations apply:

1. If the aggregate and cement are introduced into the transporting and mixing vehicle together, the procedure shall be such that they are uniformly distributed throughout the batch.
2. Vehicles used for transporting and mixing shall be so constructed as to insure rapid delivery and proper mixing without segregation or loss of the ingredients.
3. When the aggregate and cement are batched together, they shall not be transported in any case for a period in excess of one hour after the addition of the cement to the aggregate.
4. Means shall be provided so that the quantity of water added to the mix can be readily checked.

One speaker asserted that control companies produce better concrete than the usual 1:2:4, and suggested the adoption of strength specification based upon workability rather than water-cement ratio.

The discussions indicated that there are about 150 commercial concrete plants now operating, as compared with only 12 two years ago.

Frank I. Ginsberg discussed the "Design and Operation of Central Mixing Plants." Discussion of his paper brought out the interesting point that the costs of outfits are about equal with central agitators and truck mixers. H. F. Thompson favored central-mixed concrete and non-agitator trucks for mixes under 2½-in.-slump, and agitator trucks for the water mixers. Another speaker felt that trucks should hold either 1 cu. yd. or 3 cu. yd.—that the 2-cu. yd. is not economical for either large or small orders.

Concrete Pavements

H. F. Gonnerman described the Portland Cement Association's investigations of seventeen methods of curing concrete roads. The tests were grouped into four general classes—water curing, surface coating, calcium-chloride admixture, and calcium-chloride surface. His conclusions were:

1. There were marked differences in the strength of similar specimens cured in the same manner but tested wet on the one hand and "as cured"—that is, dry or semi-dry—on the other.

Cylinders tested wet always showed lower strength than when tested "as cured." In contrast to the cylinders, beams tested wet were generally stronger than those tested "as cured." Compressive strengths are given more weight because the cylinders were more thoroughly saturated than the beams after soaking in water for the periods used.

2. Cylinders cured by the various methods showed only minor differences in compression strength at ages of one to seven days, most of them having strengths equal to or greater than water-cured cylinders at these ages. However, after three months and one year none gave strengths equal to continued water curing.

Cylinders cured in Sisalkraft bags or by means of Tarvia, McEverlast paint, Curcrete, linseed oil and paraffin had approximately the same strength at the different ages as cylinders cured in a moist room for thirteen days. Compression strengths for these methods ranged from 75 to 85 per cent at three months and from 58 to 76 per cent at one year of the strength of cylinders cured in water.

The results indicated that the coating of sodium silicate was of little or no value as a means of curing concrete, also that the admixture of calcium chloride (2 per cent by weight of cement), while increasing the strength, was not a satisfactory substitute for a few days of moist curing.

3. Air-cured concrete with and without admixture of calcium chloride, concrete cured in a moisture room for two days, and concrete cured with sodium silicate had relatively low resistance to wear; while concrete cured by the other methods had approximately the same resistance to wear as concrete cured moist for thirteen days.

4. In general, the specimens showing greatest losses of moisture at time of test had lowest strengths. Those treated with bituminous, linseed oil and paraffin coatings and those incased in Sisalkraft paper lost water gradually but greatly retarded rate compared with air-cured and sodium-silicate coated specimens.

5. Lowest absorptions were shown for the curing methods which developed greatest strength and resistance to wear.

The Clearwater Quarry

(*Continued from Page 70*)

Products and Their Uses

The Clearwater Lime Products Company ships about five carloads of from 30 to 40 tons each per week. One of its chief products is "paper rock," which it supplies to the Pacific Coast paper mills. Poultry grits are in considerable demand, while the call for the finer sizes of pulverized limestone for special uses is constantly increasing. By mixing sulphur with limestone flour, a satisfactory substitute for gypsum land plaster is produced which can be sold for $10.50 a ton, whereas the gypsum plaster would cost $18.

Limestone flour is also sold for use as a dairy mineral in replenishing the lime supply required by dairy cows in milk production; and for use as a disinfectant in place of lime. When the limestone is pulverized to pass a 100-mesh screen cloth, it is suitable for use as an antacid in nitroglycerine explosives, preventing their deterioration and rendering them safer. Shipments of this finely pulverized limestone have been made from Orofino to the Dupont Powder Company at Dupont, Wash., for such use. Eventually, it is believed, lime will become one of the important products of the plant.

Ballast for Railroads

(*Continued from Page 71*)

duced and the track riding performance greatly increased, and these factors have been obtained at a very much less capital and maintenance cost.

In conclusion, may I offer a word of advice to the superintendents of the local prepared gravel plants: Do not depend upon the railroad inspector to see that every car of ballast that leaves your plant is up to railroad or A. R. E. A. specifications. Either yourself or someone whom you can entirely depend upon should examine these cars closely, bearing in mind the fact that a few cars of poor prepared gravel can offset hundreds and even thousands of cars of up to specification ballast. An executive or railroad officer who rides over the road does not give a great deal of thought to the many miles of excellent tracks put up with A-1 gravel ballast, but his attention is quickly called to a few spots which may show that a few cars of ballast, which were not up to specifications have been unloaded. It would be far better for the superintendent or those who are responsible in charge of the quarry works, to say to the supervisor, roadmaster or division engineer as follows: "These cars are not up to standard. I want you to unload them in some yard or commercial track where they will not be subjected to heavy traffic, and we will not send you any invoice." This, in the long run, will more than pay for the few cars unloaded without charge.

The present status of the gravel industry, with special reference to railroad work, has not taken place overnight, but is the result of tireless efforts on the part of the combined gravel companies of the United States and Canada, and from the results which have been obtained from a maintenance viewpoint of many railroads. If the producer is not interested or does not take an active part in the discussions at such a convention as yours, the gravel industry as a whole must necessarily suffer.

National Highway Commission of Mexico to Hold Third Congress

The American Road Builders' Association has arranged to send its executive committee as delegates to the Third Highway Congress which is to be held April 20-27, 1930, by Mexico's National Highway Commission, in Mexico City. An official train will leave Washington, April 15, going via St. Louis and San Antonio. This occasion offers special attractions to all Americans who desire to see Mexico at its best.

Portland Cement Association Holds Regional Safety Meeting at LaSalle, Ill.

THE Regional Safety Meeting of the Portland Cement Association was held March 4, 1930, at the Hotel Kaskaskia, La Salle, Ill. The program, as in past years, was extremely interesting and several of the papers presented created considerable discussion.

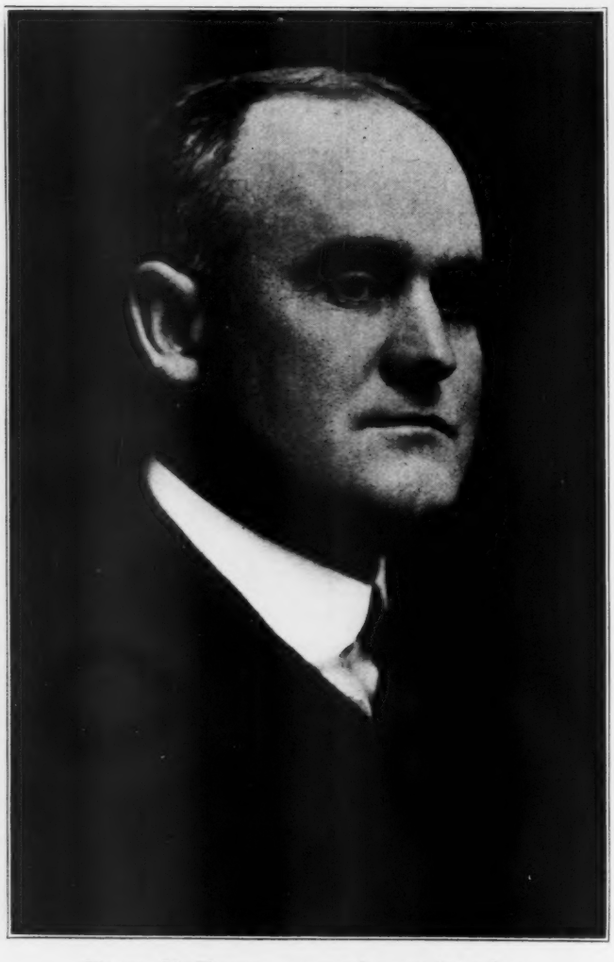
Henry McClarnan, general superintendent, Alpha Portland Cement Co., La Salle, Ill., presided at the morning session which was called at 10:00 a. m. The following papers were presented and discussed:

"Safe Practices in the Quarry," technical representative, E. I. DuPont de Nemours & Co.

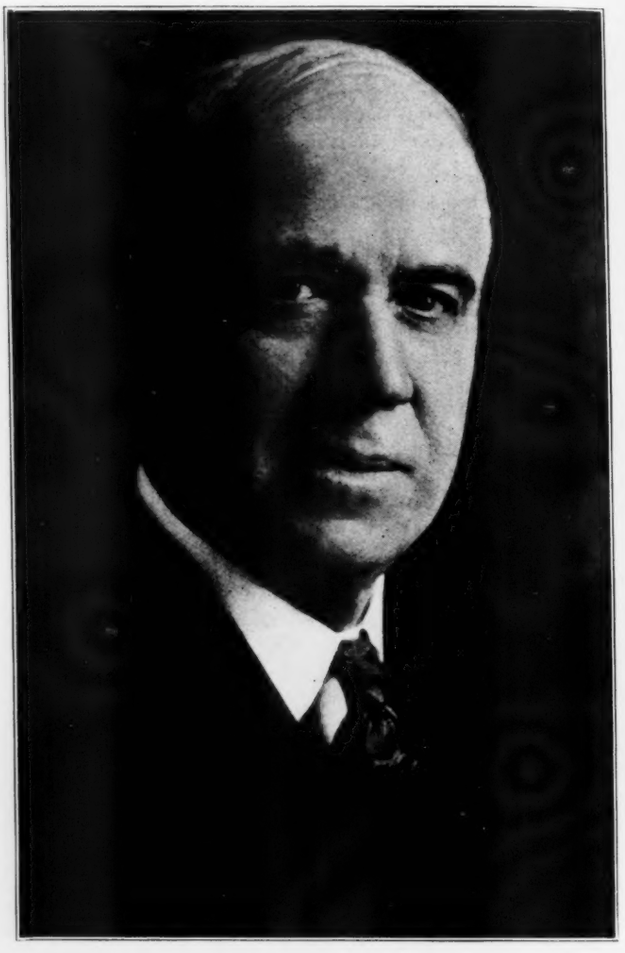
"Avoiding Accident Hazards in Shop Practice," by Walter Heath, assistant general superintendent, Universal Atlas-Cement Co., Buffington, Ind.

"How Is our Plant Housekeeping?" by John Allwood, safety inspector, Lehigh Portland Cement Co., Oglesby, Ill.

Luncheon was held at 12:15 p. m. in the banqet roo mof the hotel. John Young, superintendent, Lehigh Portland Cement Co., Oglesby, Ill., presided. Victor T. Noonan, consulting engineer, Rockford, Ill., gave an interesting address which was very well received.



Henry McClarnan, general superintendent
Alpha Portland Cement Co.



W. D. Ryan, Safety Commissioner,
U. S. Bureau of Mines

The afternoon session began at 2:00 p. m. with F. H. Sass, manager, Department of Safety and Labor, Universal-Atlas Cement Co., presiding. A number of very interesting papers were presented followed by a general discussion in which most of those present took part. The following papers were presented:

"The Foreman's Part in the Safety Campaign," by Charles Wagner, Western Clock Co., Peru, Illinois.

"Beware the Electrical Hazard," by W. C. Powell, safety engineer, Medusa Portland Cement Co.

"What About Coal Dust?" by James Bassett,

(*Continued on page* 82)

Effect of Characteristics of Aggregates on the Quality of Concrete*

Aggregate Characteristics Are of Less Importance Than Proportioning, Mixing, Placing and Curing Concrete

By STANTON WALKER

Director, Engineering and Research Division, National Sand and Gravel Association, Washington, D. C.

AGGREGATES for concrete have been the subject of much research during the past thirty years. Valuable information has been gained, but few fundamental laws, applicable under all circumstances, have been developed. Any discussion of the effect of aggregate characteristics on the quality of concrete involves many complications. It requires, first of all, an understanding of what is meant by quality of concrete, and, second, some statement of what characteristics of aggregates are significant in controlling quality; the problem is still further complicated by the necessity of introducing yardsticks by which to measure the various factors.

In this paper it has been endeavored to outline the more authoritative conclusions which have been drawn from available information; no attempt has been made to review or summarize existing data. The paper also contains suggestions concerning factors on which data are needed and points out some of the features which have made the development of exact information slow and difficult.

Concrete is a structural material which should possess strength, durability and impermeability. It consists of a hardened mixture of cement, water and aggregates. The aggregates are inert materials, with few exceptions, which are bound together in the concrete by a glue consisting of the cement and water. This mass depends for its strength on the ability of the cement paste or glue to hold it together. For durability it depends on the soundness of its constituents and the ability of the mass to prevent the ingress of destructive agencies. For impermeability it depends on the concrete materials being proportioned in such a manner that all void spaces in the mass are filled.

With this conception of concrete, it will be seen that aggregate characteristics may affect its quality in several different ways. Aggregates of different properties, such as grading, may require different qualities and quantities of the cement paste to bind them together in a mass of the necessary plasticity and workability to insure the absence of void spaces. Certain aggregates may contain impurities which will affect the hardening of the cement paste. The adhesion of the aggregate to the cementing substance may vary with different materials. Aggregates may have different abilities to resist stresses transmitted to them by the glue which binds them together.

The limitation of this discussion to effects of aggregate characteristics may tend, if judgment is not exercised, to over-emphasize their influence. As important as these are, the fact must not be overlooked that other factors, such as proportioning, curing, mixing and placing, are of as great, and in most cases of greater, importance.

Significant Characteristics of Aggregate

Aggregate characteristics should not be confused with arbitrary aggregate types such as gravel, crushed stone, or blast furnace slag. Most of the significant characteristics are common to the different types. Definite information of a fundamental nature will be obtained only from a study of each characteristic without reference to arbitrary classifications.

All characteristics of coarse aggregates are not independently significant in controlling the quality of the concrete. Those properties which are commonly listed in specifications and others which are generally considered to be of importance may be summarized briefly as follows:

Soundness and Durability. Aggregate particles which are unsound and disintegrate under the conditions to which they are exposed in the concrete may cause disruption and failure of the structure.

Hardness and Strength of Aggregate Particles. It is important that the particles be able to withstand the stresses transmitted to them by the mortar.

Surface Texture. The bond between the mortar and the aggregate particles may be influenced by surface texture.

Shape of Particle. The void content of the coarse aggregate and, consequently, the amount of mortar required to produce workability are affected by the shape of the particle.

Miscellaneous Deleterious Substances. Injurious amounts of deleterious substances cause harm to concrete in a variety of ways: organic matter affects the hardening of the cement, coatings affect the bond, dust requires additional water and contributes to planes of weakness, etc.

Size and Grading. The economy, strength, density, workability, and other properties of concrete are affected to an important extent by the size and grading of the coarse aggregate.

These factors have been found to have effects which vary in importance for the different properties of concrete. Other characteristics, such as mineral composition, specific gravity and absorp-

*Presented before the Convention of the National Sand and Gravel Association, Jan. 30, 1930.

tion, will come to mind. It is believed that the list includes the more important factors which may be expected to have a direct bearing on the quality of the concrete; other factors have, for the most part, an indirect effect which is reflected by those listed.

Soundness and Durability

Soundness and durability are prime requisites of suitable aggregates. If the aggregate particles disintegrate, the concrete will disintegrate. There are few examples of failure of structures due to the coarse aggregate, but this has been because unsound aggregates are in the minority rather than because of any lack of importance of this characteristic.

It is important to know how to identify an unsound aggregate and to know what degree of unsoundness may be permitted in concrete for different exposures. Only rule-of-thumb methods, based on experience, are available for this purpose. The problem is made more difficult because durability is a relative term; concrete which is durable under one condition of exposure may disintegrate rapidly under another. Extreme cases of sound and unsound aggregates can be identified with assurance. Border-line cases and aggregates containing a quantity of unsound particles, but otherwise unsuitable, are classified with difficulty.

Sodium Sulphate Tests

During the past few years several laboratories have carried out a large amount of work directed to the development of a test which may be used to determine whether or not an aggregate will be durable in concrete. The method of test for soundness of aggregate using sodium sulphate has received most attention.* This test consists of alternately soaking a sample of aggregate in a saturated solution of sodium sulphate for 20 hours and drying it in an oven for 4 hours. This operation, customarily, is repeated five times. It will be seen that the crystallization of the salt, on drying, exerts a disruptive action somewhat similar to that of frost. Recently, particular attention has been paid to tests by actual freezing and thawing under controlled conditions, which the sodium sulphate test is meant to simulate. This test requires special apparatus for freezing the specimens to a definite temperature and at a definite rate. For both of these methods, most of the work has been done with crushed stone, concrete and mortar. Only a few studies of gravel have been carried out.

These investigations have not yet yielded sufficient information to provide rules for passing upon the suitability of doubtful aggregates for concrete. In the case of the sodium sulphate test, the practice has been adopted by several engineers of regarding with suspicion any aggregate which does not withstand five alternations. However, many aggregates which fail in this test have given apparently satisfactory results in concrete. Moreover, the failure of a small proportion of the particles in a sample does not necessarily indicate an unsound material, even when this test is considered a suitable criterion. It is necessary to consider what proportion of the aggregate consists of such particles and to judge its acceptability from the viewpoint of whether they are present in sufficient quantities as to be injurious. In general, it may be said that aggregates successfully withstanding 5 alternations of the sodium sulphate test will possess satisfactory durability for all ordinary conditions.

The sodium sulphate test is further complicated by the fact that different results are obtained with comparatively minor variations in the method of making the test and because of the combination of mechanical and chemical action which take place. Goldbeck† reported results on one sample of stone tested by eight different variations of the method, which, after five cycles, showed unaffected particles ranging from 80 to 20 per cent of the sample, depending on the variation in test method used. It will be necessary to outline a more definite procedure for the test and this is not as simple as it may appear at first thought; it must be determined what procedure, if any, represents natural conditions.

The sodium sulphate method has not been found to give results which are directly comparable with actual freezing and thawing. Goldbeck† reported tests on a number of different samples of stone, gravel and mortar, subjected to twenty cycles of the sodium sulphate test and fifty cycles of freezing and thawing. In some cases the freezing and thawing caused more disintegration than the sodium sulphate, and, in others, the sodium sulphate test was the more severe.

Freezing and Thawing Tests

Scholer‡ has conducted what is probably the most comprehensive investigation that has been published to date on the effect of freezing and thawing on aggregates, mortar and concrete. He has demonstrated that almost any concrete can be disintegrated by freezing and thawing and that the severity of the test depends greatly on the rate of change of temperature. He found that aggregates proven to be unsound by the freezing and thawing test invariably contributed to disintegration of the concrete in which they were used, when subjected to the same test. However, the part played by the aggregate in the disintegration of the

* See "Method of Test for Soundness of Coarse Aggregate," U. S. Dept. of Agriculture Bulletin No. 1216, "Tentative Standard Methods of Sampling and Testing Highway Materials," p. 20. See also 1928 A. S. T. M. Proceedings, Pt. I, p. 362.

† "Some Observations on Accelerated Soundness Tests," by A. T. Goldbeck, *The Crushed Stone Journal*, July, 1929, p. 13.

‡ "Some Accelerated Freezing and Thawing Tests on Concrete," by C. H. Scholer, 1928 Proc. of the Am. Soc. of Testing Mats., Pt. II, p. 472.

concrete varied to a large extent, depending upon the proportions in which it was used. For example, in one group of tests, for which he varied the water-ratio, he found that, for the lower water-ratios, the failure of the specimen was almost always due to the failure of the course aggregate, while, for the higher water-ratios (.9 or more) the failure was distinctly due to the disintegration of mortar. He disagrees with the widespread belief that the mortar offers considerable protection to unsound stones; he states that it is only slightly effective in this respect. The water-ratio of .9, mentioned above, should not be considered as necessarily significant, since other mixtures and other stones would, undoubtedly, have shown a different value.

It should be clear from this discussion that studies of soundness of aggregates and their effect in concrete offer considerable difficulties. The only true test is the exposure of the concrete to actual conditions, but such a test, of course, requires a long time to complete. Accelerated tests yield valuable information, but sufficient experience has not been had with them to permit of translating their results into terms of actual life of service for different conditions. Much preliminary work must be done in a study of the test method before quantitative results may be expected. Fortunately, most concrete aggregates are sound. In the case of gravel, its method of formation by glacial and water action offers good assurance of the durability of the majority of its particles. However, many gravels contain weak and unsound particles in sufficient quantity to make important definite information as to their effect.

Hardness and Strength of Aggregate Particles

Coarse aggregate particles should be hard and strong enough to withstand the stresses which are transmitted to them by the mortar. In the case of these properties, as for soundness, there is no difficulty in identifying definitely strong or definitely weak and friable aggregates. The problem lies in the identification of borderline cases and in the determination of the effect of different amounts of weak particles. The fact that a broken test specimen of concrete shows fractured particles of aggregate is no necessary indication of lack of sufficient strength in the aggregate.

The importance of hardness and strength of aggregate varies with the service to which the concrete is subjected. If compressive strength of concrete is the important factor, a wide range in hardness and strength of aggregate particles will show little effect on this property; and, under such circumstances, it is a rather unusual case where the strength of the aggregate particle is not greater than that of the mortar. If tensile or flexural strength is the criterion, a narrower range in aggregate strength will be found within which the concrete strength is not affected. If high resistance to abrasion is required, the hardness of the aggregate particles in relation to the hardness of the mortar should be considered. If impact is the principal stress, perhaps toughness is most important. It will avoid confusion, and probably be sufficient, to limit this brief discussion to effects on the compressive and tensile strength of concrete. In the usual case, abrasion is not likely to be important if the materials and proportions are satisfactory from other considerations. Other stresses, such as impact and shear have been studied so little that sufficient information is not available to permit of even a brief statement.

The strength of an aggregate particle cannot be measured directly. Of course, in the case of stone, it is possible to obtain specimens from the quarry and test them for strength, but even this somewhat cumbersome and uncertain method is barred to gravel. A considerable amount of research has been carried out by various laboratories in attempts to develop a measure of hardness and strength of aggregates which will reflect their concrete-making properties. Most attention has been devoted to some modification of the Standard Deval Abrasion Test.* In the case of stone, the standard toughness† and hardness‡ tests have been considered. The impact test for gravel,** in which individual particles are subjected to a blow from a falling steel ball, has been studied. A pressure test on individual gravel particles, made with an instrument known as the Douglas machine,*** has been studied by the Iowa State Highway Commission and others. Abrams, in connection with his research work for the Portland Cement Association, made studies of a crushing test in which a confined sample of graded aggregate was loaded in a testing machine and the effect measured by the differences in sieve analyses before and after the test.

Many engineers have adopted the Deval abrasion test, or some modification of it, as a measure of hardness and strength of aggregate particles and have based specifications on it. Specification limits which have been adopted have resulted in the exclusion of many suitable materials. Data obtained up to this time, have not indicated any dependence

* See "Standard Method of Test for Abrasion of Rock" (Serial Designation: D2-26), 1927 A. S. T. M. Standards, p. 463, and "Tentative Method of Test for Abrasion of Gravel" (Serial Designation: D289-26T), 1928 Proc. Am. Soc. of Testing Mats., Part I, p. 940.

† See "Standard Method of Test for Toughness of Rock" (Serial Designation: D3-18), 1927 A. S. T. M. Standard, p. 464.

‡ See "Dorry Hardness Test for Rock," Bulletin No. 949, U. S. Dept. of Agriculture, "Standard and Tentative Methods of Sampling and Testing Highway Materials," p. 4.

** See 1922 Proc. Am. Soc. for Testing Mats., Part II, "An Impact Test for Gravel," by F. H. Jackson, with discussions by W. F. Purrington and Duff A. Abrams.

*** See "Method of Test for Quantity of Soft Pebbles in Gravel," Bulletin No. 1216, U. S. Dept. of Agriculture, "Tentative Standard Methods of Sampling and Testing Highway Materials," p. 20. See also 1928 Proc. Am. Soc. for Testing Mats., Part I, p. 363.

of the concrete-making properties of the aggregate on its hardness as measured by this test, nor have they shown any relationship between the test results from the standard test for crushed stone and the modified test for gravel. It must be kept in mind, of course, that the procedures for the gravel and stone tests are different. The impact test for gravel is not claimed to provide a method for measuring the hardness of gravel as a whole; it offers promise as a basis for determining the amounts of soft and friable particles present. The pressure test with the Douglas machine is only for the purpose of obtaining the percentage of rotten stone in a sample of gravel. The crushing test may offer promise as a method of measuring the strength of a graded sample of aggregate particles, but, so far, studies have not indicated any relation between this test and the concrete-making properties of the aggregate.

Brief reference to typical data showing the relation between hardness and strength of aggregate and quality of concrete should be of interest, although no attempt will be made to review all of the data. Giezecke* published results of compres sion tests of concrete made with six different crushed stones of a wide range in physical properties. Practically uniform strengths were obtained for the concrete, in spite of the fact that the strengths of the stone ranged from 4,400 to 33,600 pounds per sq. in. In fact, slightly higher strengths were obtained for the softer stones, probably due to their greater absorption reducing the quantity of mixing water. The strength of the concrete was, in every case, considerably higher than that of the weakest stone. Other physical characteristics of the stones were approximately proportional to their strengths; their resistance to abrasion ranged from 8.72 to 10 per cent, the hardness from 0 to 18.34, and the toughness from 3 to 32, as measured by standard test methods.

It cannot be concluded from Giesecke's tests that the strength of the aggregate particle, for any range in quality, is of no importance to the compressive strength of concrete. Very weak and friable aggregates give appreciably lower compressive strengths than those of good . quality. For example, tests by Abrams† show concrete strengths ranging from 2,000 to 4,500 lb. per sq. in. for aggregates, including such materials as tufa and cinders. Numerous other data show similar results.

A considerable amount of data permit of comparisons between compressive strength of concrete and the results of the Deval abrasion test for both gravel and crushed stone. These test data seem to be unanimous in failing to indicate a relationship or to show any dependence of one on the other.

For tensile strength of concrete, while the relationship, or lack of relationship, is not so clear, it seems evident that the strength of the aggregate plays a more important part than in the case of compressive strength. While tests which have been carried out indicate trends, they are difficult to evaluate on account of other variables present. For example, in tests reported by the Bureau of Public Roads,‡ a hard and strong trap was shown to have slightly lower flexural, tensile and compressive strengths, than a comparatively weak and friable limestone. Obviously, other factors, such as absorption, surface texture, and, possibly, workability, contributed to this result. In the same investigation a limestone of excellent quality gave flexural strengths 15 per cent higher than one of relatively low quality. For the tensile and compressive strengths no great differences were noted

In the same investigation,‡ there were some rather indefinite indications of the effect of strength of gravel particles on the transverse and tensile strength of the concrete. Certain siliceous gravels gave transverse strengths about 10 per cent lower than certain other siliceous gravels and there is some evidence to indicate that the differences in strength of concrete are in the same direction as differences in the strengths of the gravel particles. In these cases the compressive strengths of the different concretes were practically identical. There were no consistent differences in the results of the Deval abrasion test which would indicate that this test was significant in this connection.

Lang reported tests comparing a number of different coarse aggregates in concrete. These included two gravels, a limestone, a trap rock, and a rather soft sandstone. At 28 days the sandstone gave a lower flexural strength than any of the other materials. Its compressive strength was the highest of those for the five aggregates, probably due to absorption of mixing water. This factor undoubtedly operated to produce a higher flexural strength than would have been obtained from the same aggregate with a lower absorption.

So far as the Deval abrasion test is concerned, Kellermann concludes "that within the range in quality covered by this study, there is no relation between the quality of the coarse aggregate, as measured by the abrasion test, and the strength of concrete." Goldbeck, on the other hand, concludes from tests carried out in the laboratory of the National Crushed Stone Association, that "the Gravel Abrasion Test seems to be a good measure of the characteristics of gravels which may produce

* See "Aggregate Strength No Measure of Concrete Strength," by F. E. Giesecke, Engineering News-Record, June 29, 1922.

† See Bulletin 10 of the Structural Materials Research Laboratory, Lewis Institute, Chicago, "Wear Tests of Concrete," Duff A. Abrams.

‡ See also reports of W. F. Kellermann's tests, "The Effect of Type and Gradation of Coarse Aggregate Upon the Strength of Concrete," June, 1929, issue Public Roads.

concrete of low cross-bending resistance. A very high percentage of wear is indicative of weak material which will weaken the beam strength of concrete." A survey of all of the data on this question seems to show the preponderance of evidence to be in favor of Mr. Kellermann's conclusion.

The difficulties in obtaining authoritative information on this question will be realized. Where can one obtain two gravels or two crushed stones with particles of different strengths, but with all other characteristics the same? Synthetic aggregates have been suggested, but, while it is feasible to produce them, difficulties will be encountered in controlling their properties accurately. Work has been done with gravel sorted into its various rock types and recombined. This method offers promise of furnishing valuable information.

Surface Texture

Surface texture is a characteristic to which little attention has been given in specifications and for which no measure has been developed. Many engineers feel that it is important on account of its effect on the bond between the aggregate and the mortar. Definite information on the effect of surface texture is as difficult to obtain as on strength of particles, and for very much the same reasons; aggregates of different surface characteristics do not generally have common properties in other respects. Certain tests indicate that surface texture, or some property closely allied to it, has an important bearing on the tensile and transverse strength of the concrete. So far as compressive strength is concerned, the evidence indicates that surface texture has little or no effect.

In the tests by Kellermann different aggregates gave rather large differences in transverse strengths, which, in many cases, could be accounted for most plausibly by differences in surface texture. When these test results are corrected for differences in cement content,* they show two high-grade limestones to produce flexural strengths about 15 per cent higher than a trap or a granite. The physical properties of these materials indicate that the strengths of the particles were well above a value which would be expected to affect the strength of the concrete. The absorptions reported indicate that the effect of this factor on the water-ratio did not contribute to the differences in strengths. Differences in bond between the mortar and the stone would account for them. The suggestion has been made that chemical action between the cement and the limestone may account for higher strengths with this material. There is, however, little definite evidence to support this view. In the same group of tests, a glacial gravel consisting of strong and rather rough textured particles gave flexural strengths about 10 per cent higher than a water-worn gravel with smooth and, apparently, equally strong particles. In neither of these two examples were there any important differences in compressive strength.

It should be emphasized at this point that surface texture should not be confused with angularity. There is no valid evidence, with which the writer is familiar, that a gravel, for example, with a high proportion of crushed particles will produce higher strength either in compression or flexure than a similar one with a lower percentage or no crushed particles, when comparisons are made in a proper manner.

Shape of Particle

A great deal of misapprehension has existed concerning the effect of shape of aggregate particle. It has been variously claimed that this factor does not affect the strength and that it has an important effect on the strength, but it is felt that neither of these conclusions is based on proper account of differences in cement content and workability.

From studies limited to compressive strength, it has been the generally accepted conclusion that the shape of particle (and also other characteristics within wide limits) has little or no effect on the strength when comparisons are made for the same proportions. This conclusion leaves out of account the fact that differences in shape of particle affect the voids of the aggregates, and, consequently, the amount of cement per unit of volume of concrete and the amount of mortar in relation to the voids; the aggregates with the lower void content contain less cement and a larger amount of mortar in proportion to the voids.

With increased attention to transverse and tensile strength, belief developed among many engineers that particles angular in shape produced higher flexural strengths than those of rounded shape. This conclusion seems to be based on comparisons which do not take into account the effects of other aggregate characteristics, difference in cement contents, and workabilities.

The writer's conclusions in this respect are stated clearly in his discussion of Mr. Kellermann's paper, published in the December, 1929, issue of the *National Sand and Gravel Bulletin*. They are the following:

"If the same quality of cement per unit of volume of concrete and a volume of mortar in proportion to the voids in the coarse aggregate are used in the concrete, flexural strengths obtained using aggregates with rounded particles are at least as high as those obtained with angular particles.

"If the cement content and volume of mortar are taken into consideration as suggested above, the compressive strength of concrete made with coarse aggregate consisting of rounded particles generally will be higher than that of concrete made with angular particles."

* "Effect of Type of Coarse Aggregate on the Strength of Concrete," Discussion by Stanton Walker of Kellermann's reports, *National Sand and Gravel Bulletin*, December, 1929.

The use of the same proportions by volume of angular and rounded materials results in important differences in cement contents, those with low voids containing less cement than those with high voids. This practice also results in widely varying amounts of mortar in proportion to the voids in the coarse aggregates and such variations must necessarily result in different conditions of workability.

In comparing aggregates of different void contents in concrete, it seems entirely reasonable to require that the cement content be maintained constant and that a quantity of mortar be used in each case which will produce comparable workabilities. Preliminary experiments have indicated that this will be accomplished if approximately the same ratio of volume of mortar to volume of voids in the coarse aggregate is maintained. Studies of Mr. Kellermann's data on this basis lead to the conclusions which have been quoted above. Tests now under way in our laboratory will throw additional light on this question.

Miscellaneous Deleterious Substances

Deleterious substances in coarse aggregate for concrete are commonly limited by some such indefinite phrase as "free from injurious amounts of soft, friable, thin, elongated, or laminated pieces, dust, clay, clay lumps, coatings, alkali, organic or other deleterious matter." Only rarely are attempts made to place definite specification limits on them, and, when limits are stated, they are based almost entirely on engineering judgment rather than definite information. In many cases the effects of the various so-called deleterious substances cannot be determined readily from controlled laboratory tests and the formation of judgment from service records is made difficult on account of the widely varying effects which are found in different types of structures.

Soft, friable, thin, elongated or laminated pieces are generally considered most objectionable in concrete for which the surface appearance is of importance, and particularly in cases where the surfaces are subjected to abrasion. In a concrete road slab, for example, soft and friable pieces, which are likely to be lighter than the aggregate, may be worked to the surface during the finishing process. The action of traffic and the weather may cause their disintegration and the formation of pits in the surface. Surface pits are objectionable principally from the viewpoint of appearance. They rarely contribute to the progressive disintegration of the surface. It is a popular conception that surface pits, formed by soft pieces will "ravel" under the action of traffic. Careful inspections, made by the writer, of roads containing a great number of pits formed by soft particles have failed to indicate any evidence of ravelling or progressive disintegration on account of them.

Soft and friable particles, in the quantities which they are apt to occur in aggregates considered for use in concrete, generally have an unimportant effect on the strength, so far as available test data show. No comprehensive study of this question has been published. A prominent state highway department has carried out tests on gravel carefully sorted into its different rock types and recombined to contain definite percentages of soft and friable particles of different natures. The results of these tests are not as yet available. Thin, laminated particles have much the same effect as those classified as soft and friable.

Elongated particles are often limited, it is believed, on the assumption that they are always friable and possessed of little strength. When elongated particles are unsatisfactory from a view point of hardness and durability, their effects will be much the same as soft ones. However, in many cases, particles which may be classified as flat and elongated are entirely satisfactory in other respects. The research laboratory of the National Sand and Gravel Association has recently carried out an investigation in which concrete made with gravel containing flat particles up to about 14 per cent was compared with concrete made with the same gravel from which the flat particles had been removed. These tests failed to reveal any reduction in strength due to the flat particles. Careful studies of surface texture of vigorously finished slabs failed to indicate any likelihood that the flat particles would have a tendency to float to the surface during the finishing process and arrange themselves in such a way as to be broken out by traffic.

Shale is a common material which sometimes occurs in gravel deposits and in certain stone ledges, and which is known to be unsound in concrete. Comprehensive studies of the effect of shale in Minnesota gravels have been carried out by F. C. Lang of the Minnesota State Highway Department. As a result of these studies, Mr. Lang points out that quantities of shale less than will produce a harmful effect on the compressive strength should not be permitted, particularly for wearing surfaces, as he feels that the shale invariably will be worked to the surface and form spots which will disintegrate at an early period under the action of the weather and traffic. The writer's comment on this conclusion is that, if the shale shows evidence of its presence by surface pits only, little harm will be done; however, shale in excessive quantities may cause disruption of the concrete when exposed to severe conditions.

A study of the data indicates about 5 per cent reduction in strength for gravel containing 10 per cent of shale when the concrete was cured for 28

days in a moist condition under normal temperatures and about 20 per cent reduction when it was exposed from the age of 2 days to 28 days to alternately freezing and thawing temperatures. Of course, no quantity as large as 10 per cent is suggested as a specification limit. Most of the state highway departments place only the term "free from" limits on shale and similar materials, although Kansas, Iowa and Minnesota specify a maximum of 1 per cent shale for gravel, Kentucky 1 per cent shale, slate, etc., and Michigan 3 per cent of shale and other non-durable particles. Mr. Lang concludes, further, that the strength of concrete varies inversely with the percentage of shale in the coarse aggregates.

Dust and clay are objectionable, principally on account of their effect in forming planes of weakness or soft and friable surfaces. Laboratory tests of aggregates containing considerable quantities of dust and clay fail to indicate any important reductions in strength, but observations of structures, particularly those subjected to the action of the weather, show excessive amounts of dust and clay to be one of the most common causes of disintegration of concrete. They are particularly objectionable in concrete containing relatively large quantities of mixing water or in concrete subjected to vigorous finishing methods. Clay lumps, if broken up in the mixture and distributed through the mass, will cause pits in the concrete and sometimes pockets in the interior which will permit of frost action. Coatings which adhere to the aggregate particles during the mixing of the concrete are harmful because of their effect on the bond between the mortar and aggregate. Their films of wet clay or dust are often classified as coatings; unless they adhere to the aggregate surfaces their effect will be the same as a similar amount of loose dust and clay.

The presence of alkalis in gravel is not common. In general, tests have shown them to have little effect on the strength of the concrete for the quantities in which they are apt to be found.* They are particularly objectionable in certain classes of concrete work on account of the effect which they have in producing efflorescence on the surface.

Organic matter is objectionable in aggregate on account of its reaction with the cement to retard the hardening. Thorough washing of the aggregates will almost invariably remove such material and there is little excuse for its presence.

"Other deleterious substances" is a somewhat indefinite classification and further research is needed to identify the substances and to determine their effects. Material such as coal, lignite, mica, oils, etc., should be considered.

* "Tests of Impure Water for Mixing Concrete," by Duff A. Abrams, Bulletin 12 of the Structural Materials Research Laboratory, Lewis Institute, Chicago.

Grading of Coarse Aggregate

More definite information has been developed on the effect of grading of aggregate than on any other of its characteristics and there may be considerable disagreement with the statement that the information available is not sufficient to permit drawing definite conclusions. The determination of the effect of grading of coarse aggregate is complicated by the many other factors which contribute to the strength of concrete. Comparisons between different gradings should be made in concretes containing the same quantity of cement and of the same workability. It is lack of knowledge of what constitutes workability in concrete that most complicates the determination of the effect of grading. Comparisons between two materials for which the ratio of fine to coarse aggregate is maintained the same will show entirely different results than if the ratio of fine to coarse is varied in an endeavor to make the concrete have the same appearance so far as that intangible property, commonly referred to as workability, is concerned.

Probably the most definite conclusion which can be drawn from a study of data which are available is to say that, in general, coarser gradings produce higher strengths but that the effect of grading of coarse aggregate is very much less than it is commonly believed to be. Tests carried out in the research laboratory of the National Sand and Gravel Association on gravels graded to cover the extreme range of common specification limits have shown comparatively minor differences in strength—less than 10 per cent. In the study by W. F. Kellermann, referred to previously, the conclusion was arrived at "that, within the limits of the study, variations in the grading of coarse aggregate have no consistent effect upon the strength of the concrete."

Mr. Kellermann points out, however—and this point deserves emphasis—that it should not be inferred that control of gradings is not important. Variations of grading occurring during construction not only affect the yield when measurements are made by volume, but also affect the workability and, therefore, the uniformity of the concrete.

Cement Tariff Situation Assumes More Favorable Aspect

The cement tariff situation assumed a more favorable aspect on March 7 when the United States Senate, after its recent action of restoring cement to the free list, reversed itself and put cement back on the dutiable list. The amendment to impose a duty of 6 cents per 100 pounds was adopted by a vote of 45 to 37. The House of Representatives had previously passed a bill calling for a duty of 8 cents per 100 pounds which was killed in the Senate on January 31 by a vote of 40 to 35.

Regional Safety Meeting

(*Continued from page 74*)

plant engineer, Lehigh Portland Cement Company.

"Safe Storage, Packing and Shipping," by C. A. Buchman, shipping foreman, Medusa Portland Cement Co., Dixon, Ill.

"Observations About First Aid Training," by W. D. Ryan, Safety Commissioner, U. S. Bureau of Mines.

"What the Figures Show About Our Safety Progress," by A. J. R. Curtis, Portland Cement Association.

Central States Safety Congress to Meet at Kansas City

The Fourth Annual Central States Safety Congress is to be held March 24 and 25, 1930, at the Muehlebach Hotel, Kansas City, Mo. This Congress is sponsored by the National Safety Council and all its sections, the Kansas Safety Council, the Associated Industries of Kansas, the Associated Industries of Missouri, and numerous other organizations. All meetings are to be held at the Muehlebach Hotel except those of the Cement Section, which will be at the Kansas City Athletic Club.

Registration of delegates will begin at 9:00 a. m. on Monday. The remainder of the day will be devoted to general sessions, of interest to all delegates, with a Railroad Rally in the Ball Room at 8:00 p. m. On Tuesday there will be separate meetings of the different sections. The Cement Section will meet at 10:00 a. m. and again at 2:00 p. m. in the Reception Room of the Kansas City Athletic Club. W. W. Williams, Employers' Reinsurance Corporation, Kansas City, Mo., will be chairman at these meetings, the program of which is reprinted below.

10:15 "Safety in Industry." Dr. F. V. Meriwether, U. S. Bureau of Mines, Picher, Okla.

10:45 "Powdered Coal." J. G. Stadler, Lehigh Portland Cement Co., Iola, Kans.

11:00 "Responsibilities of Foremen from the Angle of Foremen's Opportunities." Guy Gardner, Ash Grove Lime and Portland Cement Co., Chanute, Kans.

11.15 "Packing and Loading." R. A. Loveland, Dewey Portland Cement Co., Dewey, Okla.

11:30 "Machine Shop." J. J. Adams, Consolidated Cement Corp., Mildred, Kans.

11:45 "Quarry." C. P. Mitchell, Monarch Cement Co., Humboldt, Kans.

2:00 "Electrical Hazards." George Burgess, Missouri Portland Cement Co., Sugar Creek, Mo.

2:15 "Housekeeping." L. J. Wheeler, Lone Star Cement Co., Bonner Springs, Kans.

2:30 "Yards." A. K. Frolich, Ash Grove Lime and Portland Cement Co., Louisville, Neb.

2:45 "Waste Heat." C. M. Carman, Universal Atlas Cement Co., Atlas Division, Independence, Kans.

3:00 "June No-Accident Month, Its Advisability." T. F. McClaren, Consolidated Cement Corp., Fredonia, Kans.

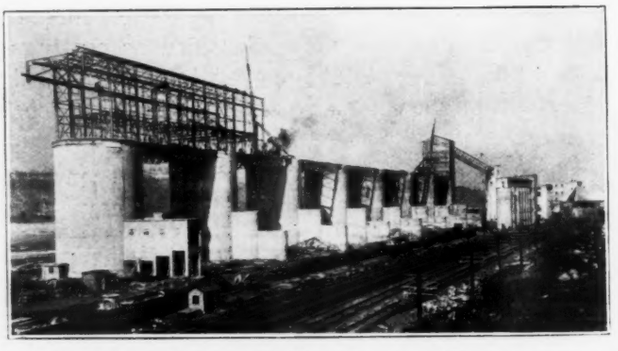
3:15 "Work of the Portland Cement Association." E. R. Rogers, Portland Cement Association, Kansas City, Mo.

3:30 First Aid Contest.

The Banquet will be held at 6:30 p. m. in the Ball Room of the Muehlebach Hotel. T. J. Strickler, president, Kansas City Safety Council, will preside. There will be two addresses and other lighter entertainment.

Steel Construction Proceeds Rapidly in New Trap Rock Plant

The February 26 issue of PIT AND QUARRY contained an up-to-date description of the large plant under construction at Clinton Point, N. Y., by The New York Trap Rock Corporation.



Crushing plant and tailing dump. Allen quarry on hill in background

The contract for the erection of the complete plant was awarded to The Burrell Engineering and Construction Company, Chicago, Ill. The Lackawanna Steel Construction Corporation, Buffalo, N. Y., received a sub-contract for all of the structural steel, its fabrication and erection. The work is proceeding rapidly, as is evident in the accompanying most recent view. The gross weight of the structural steel in this job is about 2,100 tons. The picture shows, left to right, Building No. 4, Building No. 6, and Building No. 2.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

A. F. Krabbe

General Superintendent
Olympic Portland Cement Company
Bellingham, Washington

Oklahoma Portland Cement Company Conducts Systematic Safety Practices

By H. W. Miller, Safety Director

ACCIDENTS at Oklahoma Portland Cement Company mills and quarry were pretty frequent in 1924. A big construction program was on. A grand total of 46 accidents, three permanent disabilities and one fatality occurred that year. That fatality, in which the life of a fine young man was crushed out of him by a slide, was a momentous tragedy. The whole organization was ready for some kind of a constructive educational program to reduce accidents.

So, in 1925, our present safety department was organized. Safety committees and a safety council came into existence. However, safety methods were pretty much experimental. Most all of our work was talk, although that helped. Accidents fell from 46 in 1924 to 24 in 1925. But two fine young men lost eyes. June was made without a lost-time accident. That was so great an achievement that we celebrated with a barbecue for all employees and their families.

Educational work went on in 1926. That year we had no fatalities nor permanent disabilities, and the off-time accidents were reduced to eleven. We went through June without an accident again. Another barbecue satisfied us. Then came a fatality in 1927. A young man who had been employed by the company for just a few months was killed in a premature explosion at the quarry. Our off-time accidents were reduced to ten. June brought us another barbecue, for we made it without an off-time accident. When 1928 came, there was a decided falling off in safety interest and enthusiasm. For the first time, we lost a barbecue in June and had accidents in that month of "No accidents for all plants." Our list of accidents went back up to 20. Looked a little like safety had gone up Salt River.

There had now been four years of educational work. Other mills and quarries were making a whole year without an off-time accident. Here we were in 1929, and our record for 1928 was decidedly bad. Something was very much wrong somewhere. The monthly bulletin put out by the Portland Cement Association formed the basis for many discussions. After much thought, it was decided to organize the whole organization into smaller groups. Monthly group meetings were held. Accidents common to the particular group were considered particularly, but accidents in other departments were discussed too, because of the shifting of employees from one group to another.

Much more attention was also given to the personnel of the new employees, of whom physical examinations were required. A closer check-up on all minor accidents was made. Knowing the real and complete reasons for every accident was sought. A first-aid course was given all employees by the U. S. Bureau of Mines. Certificates were awarded to 357 men. Two big bulletin boards, one at the quarry and one at the mills, giving the daily standing of every foreman and of his group were placed near the time-clocks. The standing of the foremen was published monthly, too, so that all the home folks would know just how they stood. The closest kind of a check-up was made on all minor injuries and all first-aid cases. The name of every man who came for first aid was placed on a record book. Each day that book was reviewed by the director of safety. A few employees were discharged for drinking and for selling booze. Discipline was more strictly enforced. Gold watches were offered to the five foremen who had the best safety records for the year 1929. A gold watch was also offered to one employee of every group that went through the year without an accident. One accident to the group made all the others ineligible. However, one exception was made, and that was if an employee in one group having the accident performed some kind of heroic work in the rescue of another employee, he also was eligible for a watch. We did this because when we had our fatality at the quarry in 1927, two fine, brave employees risked their own lives in their attempt to rescue the employee who lost his.

The results of this 1929 reorganization are very apparent. The methods employed have justified themselves. The quarry up to January 1, had finished 490 days without an accident, and had gone clear through the calendar year of 1929 without a single off-time accident. Our entire organization of approximately 360 employees went for 7 months and had but one off-time accident. We closed the year with but seven off-time accidents at the mills and without any at the quarry.

Oklahoma Portland faces 1930 with optimism, with plans, and with determination. We know that we ought, that we can, and that we will, make 1930 a much more successful year from the standpoint of safety. Management and men are agreed upon this. With our planning, preparing and working harmoniously for a safer year, a still greater reduction in accidents is bound to result.

Mineral Production of the United States in 1929

The estimated total value of mineral products in the United States in 1929 was approximately $5,900,000,000, as announced by Scott Turner, Director of the United States Bureau of Mines, Department of Commerce. This is an increase of nearly 10 per cent over the total value of mineral products in 1928, and is due to increases in the total value of metals and the mineral fuels produced. The total value of nonmetallic mineral products in 1929 decreased slightly as compared with 1928. The increase in the value of metallic products is due chiefly to the increase in quantity and unit value of copper and iron produced. Lead and zinc also increased, but gold and silver decreased. The value of each of the mineral fuels produced showed increases, especially petroleum and natural gas. The total quantity of petroleum produced changed little, but there was a slight increase in the unit value. On the other hand, the total quantity of coal produced increased appreciably, but the total value increased relatively less, because unit values were lower.

The following figures give the estimated total value of metallic mineral products and nonmetallic mineral products other than fuels and of mineral fuels produced in the United States in 1929:

Estimated value of mineral products of the United States 1929.

Metallic	$1,540,000,000
Nonmetallic (other than fuels)	1,200,000,000
Mineral fuels	3,160,000,000
Total	$5,900,000,000

These estimates are subject to revision and replacement by precise figures for 1929 as soon as the Bureau of Mines can complete the canvass of mineral industries just begun. In this canvass, the Bureau is sending to every mining, quarrying, and well-operating company an inquiry soliciting a report on the output of each mineral commodity by each producing establishment. Early success in this undertaking is dependent upon the continuation of the prompt and cordial response on the part of the mining companies which through many years has been the basis of success in this statistical endeavor.

MANUFACTURERS' PUBLICATIONS

Each publication listed below contains information of interest to non-metallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when making such requests.*

Bins

Into the Sunset. 8 p., 8 ill. (Folder. The Neff & Fry Co., Camden, O.) Compares the former methods of life to the present and deftly illustrates the bin with the super-concrete stave as a marked advancement in storage facilities.

Cement

Universal Atlas Dealer. 16 p., 14 ill. ("A Magazine about the Dealer's Business," March issue. Universal Atlas Cement Co., Chicago, Ill.) An article on Collection Letters with types by George T. Heppenstall is worthy of note as the ideas incorporated are of unusual value.

Crushers

Champion Roller Bearing Crushers. 4 p., 5 ill. (Bulletin KRC. The Good Roads Machinery Company, Inc. Kennett Square, Pa.) Especially features the SKF roller bearings together with a description of the design and construction of crushers.

Farrel-Bacon Crushers. 32 p., ill. (Earl C. Bacon, Inc., 26 Cortlandt St., New York, N. Y.) Catalog with contents systematically arranged that illustrates and describes by diagrams and text the different crushers made by the company.

Good Roads Champion Rock Crushers, 8 p., 13 ill. (Bulletin KPC. The Good Roads Machinery Co., Inc. Kennett Square, Pa.) Describes the Champion jaw crushers and includes materials and design.

Good Roads Climax Rock Crushers. 4 p., 4 ill. (Bulletin CPC. The Good Roads Machinery Co., Inc., Kennett Square, Pa.) Describes the three sizes in this class and includes their operation.

Drill Steel

A Handbook of Rock Drill Steel. 48 p., 91 ill. (Circular 72-K. Sullivan Machinery Co., Chicago, Ill.) Information on the selection, heating, forging and tempering of drill steel and including instructions for the care and use of Sullivan drill sharpeners and drill steel furnaces.

Excavators

Marion Type 490 2¼*-cu. yd. Excavator,* 16 p., 25 ill. (Bulletin No. 342. The Marion Steam Shovel Co., Marion, O.) Gives a complete description of this practical electrically-operated excavator.

Marion Type 450 1¼*-cu. yd. Excavator.* 16 p., 27 ill. (Bulletin No. 343. Marion Steam Shovel Co., Marion, O.) This excavator, which is the result of Marion experience, is powered by electric, gas-electric or diesel-electric as desired.

The Right Arm of Progress. 32 p., 45 ill. ("A booklet inspired by the great accomplishments of the men of excavation who are contributing today to the world of tomorrow." Bucyrus-Erie Co., South Milwaukee, Wis.) A short history of excavator progress with special reference to the part this company had in these developments.

Ground Pressure Data. 12 p., 9 ill. (Folder. Northwest Engineering Co., Chicago, Ill.) Deals with the value of low ground pressure and corrects some theories on how the ground pressure of shovels, cranes and draglines should be figured.

The P & H Crowd. 24 p., 36 ill. (Bi-monthly. The Harnischfeger Corp., Milwaukee, Wis.) Interesting to users of shovels, cranes and draglines. Continues the discussion, "The Fuel Straining System," by F. Saldit.

Hoists, Skip

The Link-Belt Skip Hoist. 48 p., 70 ill. (Book 946. Link-Belt Co., Chicago, Ill.) A complete description of skip hoisting and including illustrations of a large number of plants where this type skip is used.

Miscellaneous

Haynes Stellite. 30 p., 28 ill. (Booklet. Haynes Stellite Co., Kokomo, Ind.) A completely revised booklet which brings the properties of this material to date and shows its application in industry.

Good Roads Champion and Climax Bucket Elevators, Belt Conveyors, Bin Gates and Chutes. 12 p., 21 ill. (Bulletin ECF. The Good Roads Machinery Co., Inc., Kennett Square, Pa.)

Devotes considerable space to each of these equipment and includes some information on the class of material entering into its construction.

Individuality. 4 p., 6 ill. (Folder. Traylor Engineering and Manufacturing Co., Allentown, Pa.) Devoted to facts about Traylor installations in the cement industry and listing the different catalogs of the company.

Pulleys

Industry's Approved Method for Exact Speed Regulation. 16 p., 14 ill. (Folder. Reeves Pulley Co., Columbus, O.) Describes and illustrates power transmission through pulleys.

Pulverizers

Fuller Lehigh Pulervizing Mills. 4 p., 5 ill. (Bulletin 902. Fuller Lehigh Co., Fullerton, Pa.) Describes the different application of this type and shows assembled units.

Refractories

Arcofrax Hot Zone Lining Records. 4 p., illustrates with records. (Bulletin. General Refractories Co., Philadelphia, Pa.) These records were made in the kilns of a prominent mid-west cement manufacturer.

Screens

Centrifugal Vibrating Screens. 8 p., 6 ill. (Bulletin 1470. Allis-Chalmers Manufacturing Co., Milwaukee, Wis.) Complete description of screen together with plans for installing these units.

Good Roads Revolving Screens. 8 p., 12 ill. (Bulletin KRS. Good Roads Machinery Co., Inc., Kennett Square, Pa.) Gives the different sizes, types and methods of operating.

The Good Roads Vibrating Screen. 2 p., 1 ill. (Bulletin KVS. The Good Roads Machinery Co., Inc., Kennett Square, Pa.) Shows this vibrating screen which was designed to round out a complete line of equipment for sand and gravel and stone-crushing plants.

Washers

The Good Roads Sand Wash Box. 4 p., 4 ill. (Bulletin KWB. The Good Roads Machinery Co., Kennett Square, Pa.) Illustrates and describes the operation of this wash box and includes some useful data.

Water

The Economy of Soft Water. 16 p., 30 ill. (Bulletin No. 120. Elgin Softener Corp., Elgin, Ill.) Treats of the dangers of unsoftened water and includes methods and equipment for water softening.

Wire Rope

The Yellow Strand. 19 p., 19 ill. (Feb., 1930. Broderick & Bascom Rope Co., St. Louis, Mo.) Devoted to the uses of wire rope and featuring the new offices of the company.

New Sand and Gravel Plant Near Boston

ONE of the most representative of modern sand and gravel washing plants to be put into operation in New England recently is that of the Highland Sand and Gravel Company, at West Roxbury, Mass., a suburb of Boston. Unlike the familiar conglomeration of rough wooden framework, trestles, and haphazard storage bins, which are usually built and added onto, as the occasion requires, making up the sand and gravel operation of the old order which we see most commonly, this

Central loading hopper

plant represents a clean-cut picture which is a credit to the careful and economical design worked out by the owners and their engineers.

This plant has a daily capacity of 1,000 cu. yd. and produces three sizes of gravel, as well as plaster and concrete sand.

Operation and Equipment

The material is dug from the bank with a Lorain shovel, and loaded to a semi-portable steel hopper, which is fitted with a Link-Belt reciprocating feeder. This feeder delivers direct to the horizontal run of a field belt conveyor made up of portable steel-truss frames, and arranged so it can be extended to suit the working conditions. This belt conveyor is about 180-ft. centers at present, 16 in. wide, and is equipped with Link-Belt type 40 standard anti-friction troughing and return idlers. This conveyor, in turn, delivers to the central loading hopper. This hopper is also equipped with a Link-Belt reciprocating feeder, delivering direct to the foot end of the main incline 24-in. belt conveyor. This conveyor is about 260-ft. centers, on 18-deg. incline, and is equipped with 24-in. type 40 standard Link-Belt anti-friction troughing and return idlers.

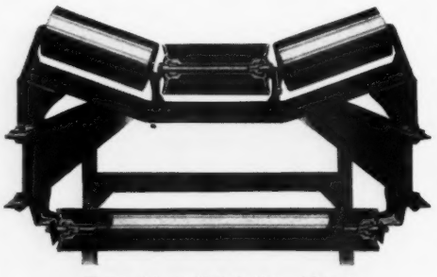
General view of plant

The conveyor is supported on a steel bridge, made up of two side girders of light construction. The internal bracing in this bridge forms the deck and walk-way on which the belt conveyor is carried.

In this plant there is no separation made of the field materials until they reach the scalping screen on top of the washing plant, where they pass through a scalping screen of heavy design, which takes out all material below 2½-in., dividing the flow to the primary and secondary crushers.

From the crushers the material passes through a screen, and thence direct to the bins. The initial separation of the material from the crushers is made over two Niagara vibrating screens equipped with wire cloth, having 2½-in. and 1¼-in. clear space. The scalping screen and rotary sizing screens for the small sizes and sand were designed and installed by a local concern.

The rejects from the crushers at the head of the plant are returned through a chute to a 16-in. belt conveyor, about 150-ft. centers, which runs on an incline to the main loading hopper, and thence returning this material into the system. This reject conveyor also is equipped with standard type 40 Link-Belt anti-friction idlers.



Type 40 anti-friction idlers

The plant has been in operation about seven months now and has given a good account of itself, without troubles or shut-downs. This entire operation is modern in appearance, and the plant operates at a high degree of efficiency.

COMING EVENTS

March 18, 1930. Des Moines, Ia. Portland Cement Association regional safety meeting, at Hotel Fort Des Moines. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

March 18, 1930. Chicago, Ill. Eighth Annual Midwest Safety Conference of National Safety Council, at Palmer House. W. H. Cameron, manager director, 20 North Wacker Drive, Chicago.

March 19, 1930. Detroit. Regional meeting, American Society for Testing Materials, at Book-Cadillac Hotel. F. O. Clements, chairman, care General Motors Co., Detroit.

March 25, 1930. Kansas City, Mo. Portland Cement Association regional safety meeting, at Hotel Muehlebach. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Apr. 5-9, 1930. New York, N. Y.; Hoboken, N. J.; Washington, D. C. Fiftieth anniversary meeting, American Society of Mechanical Engineers, at American Machinist offices in New York; Stevens Institute, Hoboken; U. S. Chamber of Commerce Bldg., Washington.

April 7-11, 1930. Atlanta, Ga. Annual meeting, American Chemical Society.

April 15, 1930. Albany, N. Y. Portland Cement Association regional safety meeting, at Hotel Ten Eyck. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

Apr. 20-27, 1930. Mexico City, Mex. National Highway Commission of Mexico third highway congress. Chas. M. Upham, engineer-director, American Road Builders' Association, can furnish particulars.

May 12, 1930. Cleveland, O. Meeting, Steel Founders' Society of America. G. P. Rogers, managing director, 932 Graybar Bldg., New York, N. Y.

May 29, 1930. Easton, Pa. Portland Cement Association regional safety meeting, at Hotel Easton. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

June 16-25, 1930. Berlin, Germany. World Power Conference. World Power Conference Program Committee, Room 818, 29 W. 39th St., New York, N. Y.

June 24, 1930. Cleveland, O. Portland Cement Association regional safety meeting, at Hotel Cleveland. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

June 26, 1930. Washington, D. C. Portland Cement Association regional safety meeting, at Hotel Raleigh. A. J. R. Curtis, secretary, 33 W. Grand Ave., Chicago, Ill.

RECENT PATENTS

American Patents

Cement

Building cement or plaster. Charles E. Kraus, Babylon, N. Y. No. 1,747,551.

Cement composition. Max E. Grunewald, Allentown, Pa. No. 1,748,839.

Conveying and Elevating

Clamshell bucket. Philip T. Robin, Lakewood, O., assignor to Jaeger Machine Co., Columbus, O. No. 1,748,586.

Conveyor system for mines and other purposes. Edward S. McKinlay, Denver, Colo., assignor to McKinlay Mining and Loading Machine Co., same place. No. 1,748,301.

Crushing and Pulverizing

Crusher. Richard Bernhard, Allentown, Pa., assignor to Taylor Engineering and Mfg. Co., same place. No. 1, 748,102.

Crusher. William I. Bowden, Philadelphia, Pa., assignor to American Engineering Co., same place. No. 1,748,828.

Crusher. Joseph E. Kennedy, New York, N. Y. No. 1,748,484.

Method and apparatus for pulverizing materials. Milton W. Arrowood, Greenwich, Conn. No. 1,747,922.

Pulverizer. George D. Harrington, Seagrit, N. J. No. 1,748,050.

Pulverizing machine. Ernst H. Elzemeyer, St. Louis, Mo., assignor to American Pulverizer Co., same place. No. 1,748,214.

Pulverizing mill. Fred J. Bullock, Shortsville, N. Y., assignor to Papec Machine Co., same place. No. 1,748,046.

Reinforced crusher plate. Clifford E. Harrison, Philadelphia, Pa., assignor to American Engineering Co., same place. No. 1,748,879.

Excavating

Digger-bucket control. Harold G. Sabin, New Haven, Conn. No. 1,748,400.

Boom mounting and bracing. Holger L. Mitchell and Rolf Ljungkull, Milwaukee, Wis., assignors to Harnischfeger Corp., same place. No. 1,747,946.

Power shovel. Charles E. Davis, Chicago, Ill., assignor to Goodman Mfg. Co., same place. No. 1,747,162.

Shoveling machine. Andrew J. Clausen, San Francisco, Cal. No. 1,747,698.

Teeth for excavating-dippers and the like. Walter E. Miley, Marion, O., assignor to Marion Steam Shovel Co., same place. No. 1,748,359.

Material Handling

Sand handling and molding apparatus. Max W. Goldberg, Port Washington, Wis., assignor to Modern Pouring Device Co., same place. No. 1,748,124.

Miscellaneous

Bank-grader. Werner Lehman, South Milwaukee, Wis., Charles N. Ballentine, Birmingham, Ala., and John W. Dahlgren, South Milwaukee, assignors to Bucyrus-Erie Co., South Milwaukee, Wis. No. 1,748,931.

Material for road surfaces and method of applying same. James F. Bennett, Dronfield, and John Hadfield, Sheffield, England. No. 1,748,535.

Road-spreading machine. Alma N. Nickerson, New Bedford, Mass., assignor to Highway Service, Inc., same place. No. 1,748,141.

Mixing

Charging device for concrete mixers. John P. Faber, Dunnellen, N. J., assignor to Ransome Concrete Machinery Co., Plainfield, N. J. No. 1,748,117.

Mixing machine. Lionel J. B. Blake, Bishops Stortford, England. No. 1,748,276.

Stucco mixer. Sidney C. Clark, Port Clinton, O., assignor to American Gypsum Co., same place. No. 1,747,466.

Screening

Revolving screen and conveyor. Joseph J. Stehling, Milwaukee, Wis., assignor to Charles H. Stehling Co., same place. No. 1,748,151.

Foreign Patents

Cement Manufacture

Utilization of the steam produced in the production of cement by the wet method. A. Eiger. British 324,798.

Process of manufacturing asbestos-cement materials. Rudolf Ludwig. Canadian 297,559.

Process for manufacture of cement. F. Taurel. French 679,969.

Process for simultaneous preparation of potassium phosphate and a cement of superior quality. E. Urbain. French 679,827.

Crushing and Grinding

Apparatus for tube mills. Maschinenbau - Anstalt Humboldt. German 491,748.

Hammermill with counter-current air separation. Hartstoff-Metall A. G. German 491,924.

Process and apparatus for the preparation of pulverized solid fuels. G. S. Loy. British 301,887.

Pulverizing mills. P. Legrand. British 312,047.

Grinding mill. A. E. G. MacCallum. Canadian 297,721.

Pulverizing apparatus. R. Genore and P. Terlin. French 679,811.

Grinding mills. J. P. Van Gelder. French 680,102.

Grinding mill. Hartstoff-Metall A. G. French 680,121.

Improved crusher. L. Turquet. French 680,164.

Crusher. G. F. Pettinos. French 680,338.

Cone crusher. Nordberg Mfg. Co. French 680,383.

Drills and Drilling

Extension drill. John Grant. German 492,053.

Apparatus for sounding bore holes. Societe anonyme d'Exploitations Minieres. German 492,573.

Rotating mechanism for rock drills. Ingersoll-Rand Co. Canadian 297,626.

Kilns

Vertical kiln for the calcination of gypsum. A. Anker. French 679,104.

Improvements in kilns for the calcination of gypsum and similar products. Mussat Binot & Cie. French 679,934.

Oven or kiln for baking pulverulent materials such as limestone, cement and the like. J. Bellay. British 324,858. (Addition to 309,177.)

Material-Handling

Shaker conveyors. M. F. Higginś and T. G. Nyborg. British 324,643.

Overhead ropeway and like conveyors. J. W. White. British 324,616.

Conveying pulverized materials. Babcock & Wilcox, Ltd., and L. Manico. British 324,800.

Idler pulley arrangement for belt conveyors. Babcock & Wilcox, Ltd., and F. W. Hollick. British 324,804.

Conveying machinery. Beckett & Anderson, Ltd., and F. Beckett. British 324,811.

Process and equipment for storing and reclaiming bulk materials. Societe Ernest Heckel. French 679,473.

Conveyor for pulverized materials. C. Peters. French 679,703.

Portable apparatus for conveying pulverized materials. Fuller Co. French 680,037.

Miscellaneous

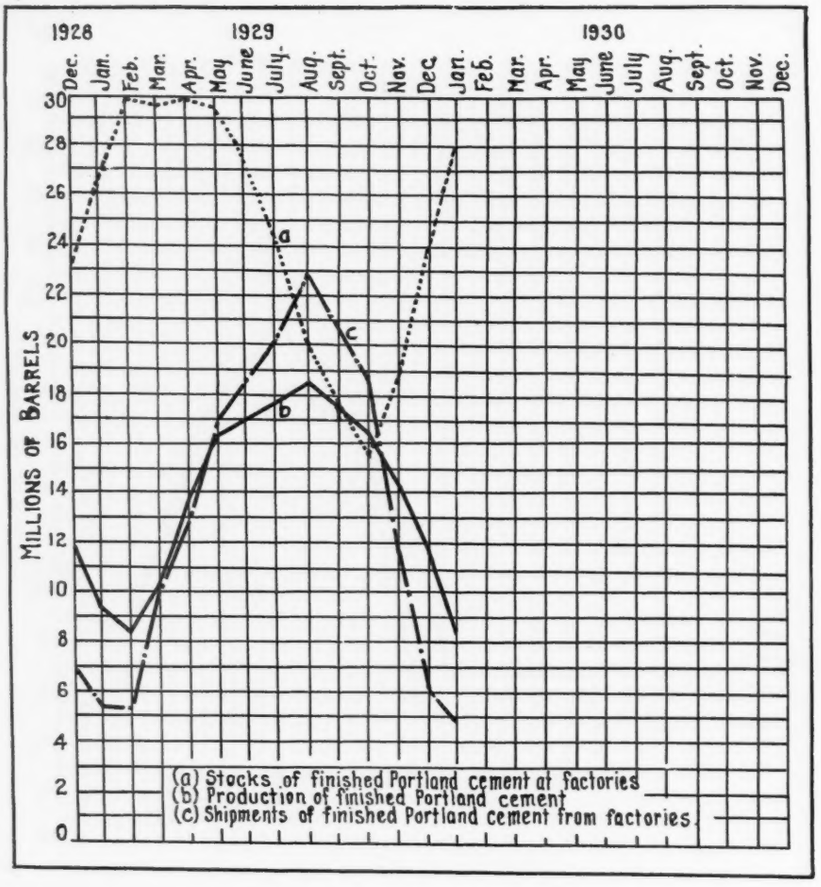
Feeding mechanism for concrete and mortar mixers. Funke & Esch. German 492,488.

Control mechanism for power shovels, cranes and the like. Baron Marks (Universal Power Shovel Co.). British 324,647.

Treating concrete. Clinton Motors Corp. British 308,207.

Gravel spreader. W. G. Smith. Canadian 297,743.

PIT AND QUARRY will furnish, at its actual cost, a copy of any patent cited above. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is theer a fixed charge per copy.


1928
1929
1930
Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
MILLIONS OF BARRELS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
a
b
c
(a) Stocks of finished Portland cement at factories
(b) Production of finished Portland cement
(c) Shipments of finished Portland cement from factories.

Portland cement, January, 1930

Relation of Production to Capacity

	January		December	November	October
	1929	1930	1929	1929	1929
	Pct.	Pct.	Pct.	Pct.	Pct.
The month	46.5	38.8	51.5	66.6	77.0
The 12 months ended	71.0	65.5	66.4	66.8	67.3

Production, Shipments, and stocks in finished Portland cement, by districts, in January, 1929 and 1930, and stocks in December, 1929. (In thousands of barrels.)

	Production		January Shipments		Stocks at end of month		Stocks at end of December
District	1929	1930	1929	1930	1929	1930	1929
Eastern Pa., N. J., and Md	2,410	2,286	1,387	1,388	6,087	6,075	5,177
New York and Maine	405	320	257	249	1,804	1,626	1,555
Ohio, Western Pa., and W. Va	818	727	430	472	3,224	3,289	3,035
Michigan	703	346	266	234	2,435	2,516	2,403
Wis., Ill., Ind., and Ky	1,047	1,377	313	327	3,423	3,926	2,876
Va., Tenn., Ala., Ga., Fla., and La	884	842	824	730	1,955	1,753	1,641
Eastern Mo., Ia., Minn. and S. Dak	1,198	758	189	214	3,891	3,140	2,595
Western Mo., Neb., Kans., Okla., and Ark.	614	701	349	271	1,610	1,886	1,456
Texas	466	321	458	317	530	817	813
Colo., Mont., Utah, Wyo. and Idaho	50	0	61	42	524	413	456
California	1,034	718	1,033	640	785	1,168	1,090
Oreg. & Wash	252	102	140	71	529	485	453
	9,881	8,498	5,707	4,955	26,797	27,094	23,550

Production, shipments, and stocks of finished Portland cement, by months, in 1929 and 1930. (In thousands of barrels.)

Month	Production		Shipments		Stocks at end of month	
	1929	1930	1929	1930	1929	1930
January	9,881	8,498	5,707	4,955	26,797	27,094
February	8,522	.....	5,448	.....	29,870	.....
March	9,969	.....	10,113	.....	29,724	.....
April	13,750	.....	13,325	.....	30,151	.....
May	16,151	.....	16,706	.....	29,624	.....
June	16,803	.....	18,949	.....	27,505	.....
July	17,315	.....	20,319	.....	24,525	.....
August	18,585	.....	23,052	.....	20,056	.....
September	17,223	.....	19,950	.....	17,325	.....
October	16,731	.....	18,695	.....	15,381	.....
November	14,053	.....	11,222	.....	18,213	.....
December	11,215	.....	a5,951	.....	23,550	.....
	170,198	.....	a169,437	.....	.....	.....

Cement Statistics for January, 1930

The Portland cement industry in January, 1930, produced 8,498,000 barrels, shipped 4,955,000 barrels from the mills, and had in stock at the end of the month 27,094,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in January, 1930, showed a decrease of 14.0 per cent and shipments a decrease of 13.2 per cent, as compared with January, 1929. Portland cement stocks at the mills were 1.1 per cent higher than a year ago.

The statistics here presented are compiled from reports for January, from all manufacturing plants except two for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants at the close of January, 1930, and of 160 plants at the close of January, 1929. In addition to the capacity of the new plants which began operating during the twelve months ended January 31, 1930.

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

Exports of hydraulic cement by countries in December, 1929.

Exported to—	Barrels	Value
Canada	1,744	$ 8,831
Central America	16,075	38,527
Cuba	5,573	12,386
Other West Indies and Bermuda	6,917	18,446
Mexico	24,686	65,870
South America	28,484	113,148
Other Countries	4,924	40,047
	88,403	297,255

Imports of hydraulic cement by countries and by districts, in December, 1929.

Imports from	District into which imported	Barrels	Value
Belgium	Los Angeles	43,816	$26,767
	Massachusetts	17,466	20,036
	Oregon	2,982	3,619
	San Antonio	9,612	9,993
	Porto Rico	500	667
	Washington	1,000	1,184
	Total	75,376	62,266
France	Massachusetts	344	1,090
Germany	Los Angeles	2,750	4,749
	New York	13	36
	Total	2,763	4,785
Italy	New York	1,180	4,338
United Kingdom	New York	3,187	4,990
	Philadelphia	1,508	1,629
	Total	4,695	6,619
	Grand Total	84,358	79,098

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in December, 1929.

	Barrels	Value
Alaska	517	$ 1,532
Hawaii	22,441	54,458
Porto Rico	6,495	13,131
	29,453	69,121

NEW CORPORATIONS

County Sand & Stone Corp., 31 Mamaroneck Ave., White Plains, N. Y. $850,000. Merger of Yonkers Sand & Stone Co., Yonkers, N. Y.; Frank D. Cooney, Inc., Yonkers, N. Y.; and F. A. Ottman & Son, Mamaroneck, N. Y. Louis J. Ottman, Pres., Mamaroneck, N. Y.; F. A. Ottman, V. P., Mamaroneck, N. Y.; Edward J. Murray, V. P., Yonkers, N. Y.; James A. Martin, Sec., White Plains, N. Y.; Frank D. Cooney, Treas., Yonkers, N. Y. Company has docks and branch offices at Yonkers, Tarrytown, Ossining, Peekskill, Port Chester, and Mamaroneck, N. Y., and will operate fleet of 80 trucks, 15 cranes, and floating digger. Will specialize in batched materials.

Guadalupe Gravel Co., Paul Schriewer, Pres., Seguin, Tex. 2,500 shares n.p.v. A. J. Wirtz, V. P.; R. A. Jahns, Sec.-Treas.

Princeton Quarries, Inc., Emma S. Williamson, Pres., Ft. of Spruce St., Princeton, N. J. $125,000. Crushed stone. Wm. J. Williamson, V. P.; Chas. A. Williamson, Sec.-Treas.

McLean Stone Co., Newsom Station, Kingston Springs P. O., Tenn. $125,000. Crushed stone.

Longmeadow Quarries, Albion, N. Y. 200 shares com. J. T. Wilson, Williamsville, N. Y.

Lime Bluff Co., Masonic Bldg., Harrisburg, Pa. $5,000. Henry H. Wilson, Pres.-Treas.; Chas. C. Hartsook, Mgr.; H. A. Reid, Sec. (Successor to quarrying and crushing business of Winston & Co., Inc., Lime Bluff, Muncy P. O., Pa.)

Midatlantic Sand & Gravel Corp., John Twohy, Pres., Norfolk, Va. 1,000 shares n.p.v.

Sypolt Sand & Gravel Corp., Frank Sypolt, Marion, Ind. 1,000 shares n. p.v. Willard Howe.

Michigan City Core Sand Corp., Carter H. Manny, Pres., Warden Bldg., Michigan City, Ind. 2,000 shares n. p.v. Howard H. Spaulding, Guy R. Knickerbocker. Will produce core sand at Michigan City dunes. Sand will be shipped by rail, but a plan for making boat shipments is being considered. Chicago office, 1928 McCormick Bldg.

Henry C. Ische & Sons, Inc., Henry C. Ische, Bender Rd., Milwaukee, Wis. 750 shares, $100 each. V. L. Ische, M. F. Ische.

Betz Grading Co., R. E. Betz, Sioux City, Iowa. $10,000. Gravel pit at Anthon, Iowa.

Springhill Pulverized Limestone Co., Point Marion, Pa. George Weightman and F. T. Fox, Uniontown, Pa. Will produce agstone.

Distribution of Cement

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during November and December, 1928 and 1929:

Portland cement shipped from mills into States in November and December, 1928 and 1929, in barrels.

Shipped to—	November		December	
	1928	1929	1928	1929
Alabama	192,012	132,035	123,522	115,961
Alaska	264	396	132	962
Arizona	56,742	43,145	42,385	46,831
Arkansas	99,304	133,371	69,131	84,761
California	1,025,113	943,641	859,234	728,509
Colorado	52,084	32,910	24,317	32,359
Connecticut	161,388	178,005	97,419	62,419
Delaware	25,357	28,275	14,122	11,737
District of Columbia	88,507	99,047	53,681	44,485
Florida	117,845	111,127	97,857	84,792
Georgia	146,394	121,871	98,912	101,776
Hawaii	22,593	26,788	20,659	19,772
Idaho	17,765	17,468	5,533	6,642
Illinois	930,003	782,779	469,527	263,469
Indiana	258,523	326,534	133,155	108,261
Iowa	96,294	127,446	34,397	35,737
Kansas	167,928	159,803	93,623	105,763
Kentucky	146,416	107,310	63,567	46,660
Louisiana	104,808	152,054	74,396	171,845
Maine	30,175	52,865	11,944	19,014
Maryland	157,297	233,983	90,219	79,751
Massachusetts	224,846	225,482	136,456	101,340
Michigan	728,972	588,511	368,112	224,563
Minnesota	124,063	130,411	52,903	52,991
Mississippi	124,113	71,069	90,745	64,336
Missouri	364,782	396,019	193,691	142,398
Montana	25,857	16,035	11,889	8,041
Nebraska	67,962	61,548	32,472	33,088
Nevada	9,566	8,173	4,029	8,279
New Hampshire	37,083	37,526	19,477	13,915
New Jersey	690,435	678,291	383,075	281,867
New Mexico	21,301	15,557	15,068	10,437
New York	1,565,942	1,441,207	1,150,410	722,146
North Carolina	248,290	110,928	148,245	66,152
North Dakota	14,375	9,564	4,237	2,161
Ohio	707,863	638,120	351,927	253,060
Oklahoma	238,178	261,283	220,102	213,739
Oregon	65,960	78,363	39,466	49,698
Pennsylvania	958,080	1,022,410	539,402	435,580
Porto Rico	500	3,520	0	4,500
Rhode Island	61,403	58,690	43,188	24,096
South Carolina	135,037	70,756	92,059	67,813
South Dakota	17,271	22,438	6,722	12,744
Tennessee	257,552	228,476	138,090	136,191
Texas	447,090	475,332	379,921	428,688
Utah	29,404	37,616	15,132	23,560
Vermont	31,272	43,012	11,026	17,560
Virginia	148,508	120,589	97,175	68,406
Washington	243,351	158,675	132,183	101,062
West Virginia	94,931	103,156	46,917	50,471
Wisconsin	258,637	224,480	114,658	80,278
Wyoming	11,987	9,346	4,428	6,690
Unspecified	32,678	0	502	0
	11,884,101	11,157,436	7,321,439	5,877,356
Foreign countries	66,899	64,564	62,561	73,644
Total from cement plants	11,951,000	11,222,000	7,384,000	5,951,000

Production and stocks of clinker (unground cement), by districts, in January, 1929 and 1930. (In thousands of barrels.)

District	Production		Stocks at end of month	
	1929	1930	1929	1930
Eastern Pennsylvania, New Jersey and Maryland	2,824	2,546	1,344	1,356
New York and Maine	585	525	1,080	813
Ohio, Western Pennsylvania, and West Virginia	1,121	999	1,189	1,212
Michigan	913	868	876	1,152
Wisconsin, Illinois, Indiana and Kentucky	1,617	1,586	1,002	858
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	1,076	901	995	732
Eastern Missouri, Iowa, Minnesota and South Dakota	1,276	790	566	575
W. Missouri, Nebraska, Kansas, Oklahoma and Arkansas	715	805	530	290
Texas	456	400	145	563
Colorado, Montana, Utah, Wyoming and Idaho	101	11	395	254
California	1,053	926	1,219	1,315
Oregon and Washington	275	147	301	526
	12,012	10,504	9,642	9,646

Production and stocks of clinker, by months, in 1920 and 1930. (In thousands of barrels.)

Month	Production		Stock end of month		Month	Production		Sotck end of of month	
	1929	1930	1929	1930		1929	1930	1929	1930
January	12,012	10,504	9,642	9,646	July	15,214	.....	11,619	.....
February	11,255	.....	12,436	.....	August	15,829	.....	8,995	.....
March	12,450	.....	14,948	.....	September	15,165	.....	7,009	.....
April	14,166	.....	15,479	.....	October	15,515	.....	5,934	.....
May	15,444	.....	14,911	.....	November	14,087	.....	6,134	.....
June	15,312	.....	13,587	.....	December	12,539	.....	7,526	.....

Exports and imports of hydraulic cement, by months, in 1928 and 1929.

Month	Exports				Imports			
	1928		1929		1928		1929	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	36,400	$204,875	78,639	$283,002	236,771	$315,797	151,302	$177,976
February	62,828	221,620	58,886	225,590	164,408	217,525	118,930	123,123
March	74,983	265,719	69,079	235,164	235,930	330,074	131,909	112,788
April	61,676	205,882	64,145	218,316	249,458	324,371	89,668	114,281
May	70,173	236,005	57,955	219,366	190,509	256,872	200,646	267,854
June	59,536	201,313	96,055	287,612	266,537	359,637	203,545	228,170
July	83,759	291,055	71,992	247,177	112,887	151,877	182,098	199,960
August	88,736	302,866	60,013	225,762	259,975	358,471	183,938	199,403
September	71,995	252,843	86,268	308,631	173,439	226,295	112,372	152,239
October	62,137	246,010	101,359	337,839	152,210	226,909	172,566	187,504
November	69,313	260,310	53,378	198,197	65,969	89,732	96,568	95,844
December	63,120	250,204	88,403	297,255	175,992	233,300	84,358	79,098
	824,656	2,938,702	886,172	3,083,911	2,284,085	3,090,860	1,727,900	1,938,240

Suggested Plant Safety Programs for April and May

By W. Dean Keefer, Director, Industrial Safety Division, National Safety Council

FOR your monthly plant safety meeting it usually is a good policy to plan one or two special program features, in addition to your regular monthly routine of business.

Your monthly safety meeting usually should include the following nine regular items:

1. Call to order promptly at the appointed time.
2. A roll call on officers and committee members with a notation by the secretary of the reasons for the absence of all committee members not in attendance.
3. Approval of the minutes of the previous meeting.
4. Unfinished business from the previous meeting.
5. Reports of committees and discussion;
6. Review of plant accidents and action on them.
7. Discussion of accidents that have happened elsewhere, possibly outlined by a special person or committee.
8. New business.
9. Exhibits of new safety devices, or old devices which represent live problems.
10. Introduction of visitors, who may or may not make remarks.

Then the meeting should be ready for the one or more special program features, as planned. These features may include a special stunt, such as a motion picture or a set of stereopticon slides. They may include a short address by a prominent plant or works official, or by a visitor.

In addition, they usually should include a thorough consideration of one or two special safety topics of general interest. Two topics briefly discussed are usually better than one topic, since they afford a variety and a possible contrast of safety problems and bring out a greater number of plant experiences and problems.

If the plan for the consideration of one or two special topics each month is followed, such topics should be selected well ahead. It is best, in fact, to select topics ahead, at least tentatively, for the entire year. If there is any doubt among the program committee members as to what might be considered the most important general topics for the year, a plant contest might be arranged with a liberal prize offered for the best list of monthly topics for the year. There might be times, during the course of the year, when some emergency condition in plant safety might displace the regular program. But, unless there is a good reason to the contrary, the yearly program should be consistently followed, with careful consideration of seasonal importance of the topics. This plan also permits advance arrangements with special speakers, possibly from other plants or possibly head officials of the company who must be dated well ahead.

After such a program has been followed through for a year, the same topics usually may be repeated the next year. In fact, it might be well to plan that they shall be repeated, which gives advance notice and opportunity for assembling additional facts and making comparisons of plant progress in this field.

If such a plant program has not been arranged, a continuation of the monthly program, as suggested in a previous article in this series (PIT AND QUARRY, Jan. 15, 1930, page 69), may be helpful. Programs were outlined for January, February and March.

April Safety Program

Following are suggestions for your April safety program, featuring the two topics of "Remarks by our Plant Employment Manager" and "The Safety Value of Good Housekeeping."

As preparation for the first of these topics, the chairman of the safety committee should notify the employment manager in advance that he will be called upon to tell "How the employment manager can help the safety committee to promote accident prevention and how the safety committee can help the employment manager."

The employment manager will undoubtedly emphasize the fact that it is extremely important to teach the new worker as much about accident prevention as possible just as soon as possible after his employment.

The United States Bureau of Labor Statistics has published interesting facts in Labor Bulletin No. 298, showing that the accident rates for workers in the employ of a particular company for less than six months or a year are higher than for workers having longer service records. Here is the tabulation:

	Equivalent Full Yr. Workers	Cases of Accident	Frequency Rates (Per Million Hours Exposure)
Six months and under	512	57	37.1
Over 6 months and not over 1 year	278	29	34.8
Over 1 year and not over 3 years	357	31	28.9
Over 3 years and not over 5 years	637	27	14.1
Over 5 years and not over 10 years	814	16	6.6
Over 10 years and not over 15 years	470	4	2.8
Over 15 years	459	..	....
TOTAL	3,527	164	15.5

Accidents to new employees are due not so much to carelessness or thoughtlessness in the mill and the quarry as to lack of familiarity with the hazards and working conditions. Another factor is nervousness due to a desire to equal the production or speed of the more experienced worker.

If a worker gets off with a bad start and forms unsafe working habits, it becomes increasingly difficult to teach him safe habits of work. At no time does a worker so consciously and so willingly place himself under the helpful influence of his superiors as he does on the day he comes to work. The employment manager is interested in safety because the prevention of accidents will help to reduce his labor turnover. He can help considerably to prevent accidents by making sure the new man knows such things as:

1. The safe route between his home and the plant, as well as between the entrance gate and his place of work.
2. The general safety rules of the company such as: The use of safeguards and goggles, the necessity for reporting every little cut or scratch, use of tools, condition of tools.
3. Where to get first aid.
4. The management's desire to eliminate accidents.
5. The safety record of the plant as a whole and of the particular department in which he is to work.

Good housekeeping is a general term which applies equally to indoor and out-of-door neatness and order. Good housekeeping is one of the most important factors in accident prevention. Every day many workers are injured by falling objects, or because they trip, stumble, slip or step on objects that are in their way. Safety men, foremen, and others, in describing such accidents, are quick (sometimes too quick) to say "He had no business to be there," or "Caused by the worker's own carelessness," or "He did not look where he was going," when, perhaps, the real underlying cause was a loose wrench kicked from an overhead platform, a wheelbarrow left standing in an aisle, or a board with projecting nails, or a round bar on the floor or ground.

Good housekeeping is also an important factor in fire prevention in all shops, locker and tool rooms, or living quarters. Rubbish, oily rags, and other inflammable materials are responsible for starting and spreading many fires with their accompanying enormous loss of property and sometimes loss of life.

Good housekeeping, besides preventing accidents and fires, often saves space, time, and material. For instance, if castings or other materials are thrown on the floor in a heap, they take up considerably more space than if they are arranged in piles or stored in bins. Moreover, it takes longer to sort or count them or to make selection, and the amount of material damaged may be much greater.

Appoint one or more sub-committees to make a survey of certain departments or of the entire plant. Instruct each sub-committee to look for (and perhaps to take photographs of) unusually good or unusually bad housekeeping conditions and to make recommendations for needed improvements. In making such a survey the sub-committees should answer such questions as:

1. Are passageways and aisles and ladderways clearly marked?
2. Are passageways, aisles, stairs and fire exits in buildings, and tracks and roadways kept clear of obstructions?
3. Are proper provisions made for storing tools and materials—tool boxes, drawers, lockers, bins?
4. Are suitable refuse containers and scrap heaps properly located?
5. Are floors, walks, and platforms kept in good condition and free from accumulations of oil and water?
6. Are toe-boards or guard-rails or equal protection provided to prevent articles from falling from overhead levels onto persons passing or working below?
7. Are materials properly piled so they will not fall and so they cannot be knocked over by vibration or by passing men or trucks?
8. Are suitable cuspidors properly located in shops and other working or assembling places?
9. Are suitable provisions made to care for street and work clothes?
10. Are windows, skylights, electric lamps, and reflectors kept clean?
11. Are toilet rooms and drinking fountains properly cared for?
12. Is janitor and outside clean-up service efficient?
13. Would it be advisable to start a clean-up campaign?
14. Are workers encouraged to help keep the plant clean?
15. Would you recommend an interdepartment housekeeping contest?

Program for May Meeting

Two good topics to feature for your May safety meeting are "Resuscitation" and "Fire Extinguishment."

Resuscitation—The chairman of the safety committee should arrange for a practical demonstration of the Schaefer prone pressure method of resuscitation from gas asphyxiation, drowning, and electric shock. If he does not already have a copy of the procedure, your plant doctor or the director of your first-aid division may secure it free of charge from the National Safety Council. The Council has created an award called "The President's Medal," which will be presented to persons performing successful resuscitation in accordance with specified rules. Copies of these rules can be secured upon request.

Even though the Schaefer method may have already been explained to the members of your safety committee, it is advisable to repeat this demonstration at stated intervals and to have the members spend from five to ten minutes practicing on each other, possible as a part of the resuscitation demonstration before the meeting.

Fire Extinguishment. Practically every fire can be extinguished within the first five minutes if proper equipment is used by men who know how to use it. Successful extinguishment of fires does not, in general, require elaborate expensive equipment. The essentials are the right kind of equipment kept in good condition, in the right place, with men who know how to use it, and that it be brought into use immediately after the fire starts.

The safety committee should discuss some or all of the following questions. If desired, one or more sub-committees may be appointed to make a survey of certain departments or of the entire plant. The report of these committees might be based on these questions:

1. What types of equipment do we have for putting out fires? Sprinkler system, water buckets, fire hydrants, steam, sand, blankets, hose line, water barrels, hand extinguishers, chemical engine, sawdust and soda.
2. Has anyone ever made a map or sketch of the plant showing the location of extinguishers and shut-off valves for sprinklers?
3. Are fire pumps so located that a fire or any other emergency might easily put them out of commission?
4. Are all valves open that should be open, and all valves closed that should be closed?
5. What precautions are taken to prevent accidental or ignorant turning of valves?
6. Different sprinkler heads operate at different temperatures. Are all sprinkler heads of the proper rating to operate efficiently in the places where they are located?
7. Have any sprinkler heads become so corroded or gummed with dirt or other foreign substances that they will not operate efficiently in case of fire?
8. Are materials or shelves so close to the sprinkler heads at any point that the heads could not operate efficiently in case of fire? (See National Fire Protection Association regulations.)
9. Is there danger that any portion of the sprinkler system may freeze in cold weather?
10. Is there an automatic alarm to give notice when one or more sprinklers start to operate?
11. Is the fire hose in good condition, or is it brittle and leaky?
12. Is the fire hose ever used for any purpose except putting out fires?
13. Are all hoses and hose couplings of uniform size so they can be connected together if necessary?
14. Is hose stored so it will not deteriorate rapidly?
15. Is the right kind of nozzle provided at each hose station?
16. Is hose tested at regular intervals? When was it last tested?
17. Are hydrants located or protected so they will not be injured by cars or trucks?
18. Are pipes and hydrants flushed at regular intervals to remove sediment?
19. When were they last flushed?
20. Are water barrels and water buckets of the right type and are they in good condition?
21. Are they filled with water?
22. Who has the responsibility of keeping them filled?
23. Are necessary precautions taken to prevent them from freezing in cold weather?
24. Is a sufficient number of hand extinguishers provided, and are they properly located to furnish the necessary protection?
25. Are precautions taken to prevent their freezing?
26. Are they recharged at regular intervals? When were they last charged?
27. Are there special men in specific departments trained in the proper use of hand extinguishers?

Gypsum in New Mexico

Gypsum is found so generally distributed in New Mexico and occurs in such vast deposits and in such variety of forms that the supply is practically inexhaustible. The beds are thick, and most of the material is exceptionally pure, according to Bureau of Mines Information Circular. 6,173.

Until 1902, however, no attempt to utilize the gypsum in a commercial way had proved successful. A number of efforts have failed because of high freight rates and small, restricted local markets. Gypsum is used to a limited extent by the Mexicans, who generally have in their villages a pile of "hieso," which is calcined in ovens as needed and used for plastering the interior of their houses. Some has also been ground and used as land plaster in attempts to reclaim alkali lands. Gypsum tends to transform the "black alkali" to a less harmful salt and is practically the only substance which has been shown to benefit these lands, but its effect is slow and the treatment is more or less expensive.

In 1902 the first production of gypsum on a commercial scale was reported. The Rock Island Cement & Plaster Co. was operating a small test plant at Ancho, 25 miles north of Carrizozo, Lincoln County, on the Rock Island Railroad (now the Southern Pacific Railroad). The material was earthy gypsum or gypsite which was dug by horse-drawn scrapers, put through coarse screens, calcined in iron hoppers, and finally put through a 35-mesh screen. This plant was sold on January 1, 1911, to the Western Clay & Gypsum Products Co., and after being idle from 1913 to 1915, it was again sold in 1916 to the Ancho Brick Co. who closed it down permanently the following year.

PERSONAL MENTION

V. F. Covert

R. H. Routt, Cleveland, O., has been made president and general manager of the Columbus Gravel Company, Columbus, Ind., taking the place made vacant by **H. A. Coleman**, who recently resigned and moved to Michigan.

Walter R. Macatee has been appointed district engineer for the Portland Cement Association, in charge of work in Virginia and North Carolina. For several years he has been engaged in road promotion throughout the southeastern states, and was formerly in charge of the association's district office at Jacksonville, Fla. His new address is 904 E. Main St., Richmond, Va.

Harry W. Newton, who for several years has served the Portland Cement Association in the capacity of conservation engineer, has become affiliated with the crusher department of the Nordberg Manufacturing Company of Milwaukee, Wis. His new duties will consist largely of special investigation work as applying to sales development of Symons cone crushers. For a number of years, he served in a similar capacity while with another company. At one time, he was engaged in private consulting engineering practice in Seattle, dealing particularly with mining and metallurgical operations in the North and Northwest.

Scott Turner, director of the U. S. Bureau of Mines, was elected vice-president and director at the recent annual meeting in New York of the American Institute of Mining and Metallurgical Engineers.

H. N. Mathias and **V. F. Covert** have been elected assistant general auditors of the Westinghouse Electric and Manufacturing Company. Mr. Mathias was born in Madison, Pa. After taking a business course in Pittsburgh he joined the Westinghouse Company and has been chief cost clerk, assistant to the general auditor, the supervisor of costs and budgets. He now will have charge of installing standard cost and works accounting and will direct all works auditors.

Mr. Covert's first position with the Westinghouse Company was as a payroll clerk. He has been assistant auditor of the Krantz Manufacturing Company of Brooklyn, a subsidiary; with the South Philadelphia Works in charge of general accounts, and as auditor; and with the East Pittsburgh Works as supervisor of district accounting.

H. N. Mathias

M. C. Steffen has been appointed manager of the Cincinnati office of Cutler-Hammer, Inc., of Milwaukee, Wis. He takes the place of **R. I. Maujer**, who has resigned. Mr. Steffen moves to Cincinnati from the St. Louis office where he has been stationed the last five years. He is a graduate of the University of Wisconsin class of '23 and holds a B.S. in electrical engineering.

In the death, March 4, 1930, of **J. Harry Barbazette**, the cement industry lost a highly respected, genial member, and Alpha Portland Cement Company one of its most valued officials, the manager of operations of the company's western mills. He was born in 1882 at Terre Haute, Ind., and graduated from Rose Polytechnic Institute in 1905 with the M. E. degree.

J. Harry Barbazette

He became associated with the cement industry in 1909 when he was made superintendent of construction for the Universal Portland Cement Co. during the erection of the Buffington, Ind. plant. In 1913 he was transferred to the Duluth, Minn. plant of the same company. In 1914 he resigned to be associated with the Midwest Credit and Statistical Bureau, but returned soon to the cement industry by becoming assistant sales manager for the Lehigh Portland Cement Co. He joined the staff of the Alpha Portland Cement Co. in 1919 and held various sales and managerial positions. He has been a member of numerous important committees with the Portland Cement Association. "Barb," as he was known among his associates, had been in poor health for more than a year, suffering several strokes.

FINANCIAL NEWS
CORPORATE & BUSINESS

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

International Salt Shows Gain

During last year International Salt Company's earnings kept pace with the sharp expansion they showed in 1928. The company has declared a dividend of $1.50 per share.

After the first six months of 1929 when International Salt reported a profit of $231,298 after fixed charges and sinking fund but before federal taxes, it was estimated that the total net income for the entire year would approximate $10 a share.

The report for the year ended December 31, 1929, from International Salt Company and subsidiaries shows net income of $687,809, after interest, federal taxes, depreciation and depletion, equivalent to $11.32 a share (par $100) on 60,771 shares of stock outstanding. This compares with $439,595 or $7.23 a share in 1928.

Profit for six months ended December 31, 1929, was $448,398 after expenses, fixed charges and sinking fund, but before federal taxes, comparing with $344,477 in corresponding period of 1928.

Dolese and Shepard

This company, producers of crushed limestone, and operating stone quarries at McCook, Ill., with annual production approximating one and one-quarter million tons, has submitted its annual report for 1929.

The company's net income, after all charges, including Federal taxes, amounted to $172,591.11, or $9.01 per share on the outstanding capital stock. This compares with $175,324 earned in the previous twelve months.

The balance sheet as of December 31, 1929, shows current assets of $490,460.63 against current liabilities of $114,238.95, or at a ratio of 4¼ to 1. This compares with $455,009.83 and $101,051.57, respectively, as shown in the balance sheet of December 31, 1928.

Net working capital amounting to $376,222.00 as compared with $350,136 shown at the close of 1928.

The condensed balance sheet is:

December 31, 1929.

Current assets	$ 490,460.63
Capital assets less dep. reserve	1,077,799.55
Total assets	$1,568,240.18
Current liabilities	114,238.95
Net worth	1,454,001.23
Total liabilities	$1,568,240.18

An additional source of revenue, besides the manufacturing and wholesaling of crushed stone, is the Hawthorne disposal station. The net returns in 1929 from this source were $55,522.96, slightly higher than in 1928.

During the past year, $53,000 was expended for new equipment and the company now has a reserve available for dividends when needed amounting to $216,253.48. This consists of high-grade bonds with a minimum interest rate of 4 per cent.

Monolith Portland Cement Reports Improvements

At the annual meeting of the stockholders of the Monolith Portland Cement Co., Coy Burnett, president, told stockholders that a new "glory hole" method of loading limestone at the company's plant in Kern County, California, has been developed, and that operation by this method will decrease production costs materially. With one exception, this is the only such method used on the Pacific Coast. It is estimated that operation costs will be cut approximately $140,000 a year by this method.

Since its purchase by Monolith in 1929, the entire plant has been almost completely rebuilt and modernized. The latest improvement undertaken is the rebuilding of the kilns. When completed, the improvements on the kilns probably will effect a saving of around $240,000 a year. Increased volume of business and better prices may be looked for. The company made a contract with the Southern California Gas Co. to supply the Monolith plant with Kettleman Hills natural gas, which should result in increased efficiency.

A preliminary report for 1929 has been made by the treasurer in which the ratio of current assets to current liabilities was shown to be approximately 3 to 1. Bond interest was earned nearly three times after ample provision was made for depreciation and depletion. After providing for preferred and common dividends for 1929, the report showed a small surplus brought forward to 1930.

The board of directors was increased to seven from five members and is composed of Coy Burnett, J. J. Calkins, Mrs. I. M. Jameson, Harold B. Reed, W. D. Burnett, Alfred F. Smith and Carroll A. Low.

CURRENT DIVIDENDS

COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement	Preferred	1¾% qr.	Mar. 1	Mar. 15
Canada Cement	Preferred	1⅝% qr.	Feb. 28	Mar. 31
Canada Paving and Supply	1st Pfd.	1½% qr.	Feb. 15	Mar. 1
Cleveland Quarries	Common	$.75 qr.	Feb. 20	Mar. 1
Cleveland Quarries	Common	$.25 extra	Feb. 20	Mar. 1
Consumers Co	Pr. Pfd.	$1.50 qr.	Mar. 15	April 1
General Asphalt	Common	$1.00 qr.	Feb. 28	Mar. 15
Indiana Limestone	Preferred	1¾% qr.	Feb. 20	Mar. 1
International Cement	Common	$1.00 qr.	Mar. 11	Mar. 28
Johns Manville	Preferred	$1.75 qr.	Mar. 11	Apr. 1
Johns Manville	Common	$.75 qr.	Mar. 25	Apr. 15
Kentucky Rock Asphalt	Preferred	$1.75 qr.	Feb. 15	Mar. 1
Lawrence Portland Cement	.....	1% qr.	Mar. 14	Mar. 30
Material Service Corp	.....	$.50 qr.	Feb. 15	Mar. 1
Metropolitan Paving Brick	Preferred	$1.75 qr.	Mar. 15	Apr. 1
Metropolitan Paving Brick	Common	$.50 qr.	Feb. 15	Mar. 1
National Brick of Laprarie	Preferred	$.75 qr.	Feb. 28	Mar. 15
Newago Portland Cement	Preferred	$1.75 qr.	Mar. 26	Mar. 31
New York Trap Rock	Preferred	$1.75 qr.	Mar. 20	Apr. 2
Peerless Cement	Preferred	$1.75 qr.	Mar. 20	Mar. 31
Raybestos Manhattan	Common	$.65 qr.	Feb. 28	Mar. 15
Superior Portland Cement	Class A	$.27½ M	Mar. 23	Apr. 1
Texas Gulf Sulphur	.....	$1.00 qr.	Mar. 3	Mar. 15
United States Gypsum	Preferred	$1.75 qr.	Mar. 15	Mar. 31
United States Gypsum	Common	$.40 qr.	Mar. 15	Mar. 31
Virginia Carolina Chemical	Pr. Pfd.	1¾% qr.	Feb. 17	Mar. 1

LEGAL INFORMATION FOR OPERATORS

Discriminating Freight Rates

That rebating may be accomplished by indirect methods has been decided in many well-reasoned higher Court cases. Therefore, the Courts look through obscurities by which the true intentions of the parties are made apparent.

For instance, in the recent leading case of Federal Gravel Co. v. Detroit & M. Ry. Co., 226 N. W. 677, it was disclosed that the Federal Gravel Company owns two gravel pits on the line of the Detroit & Mackinac Railway Company and had invested in such enterprise approximately $178,000. The railway company also owned and operated a gravel pit to supply its own needs. Subsequently, the railway company entered into the commercial production of gravel at this pit and increased its investment in the enterprise to upwards of $145,000.

However, legal proceedings resulted in the deevlopment of the fact that the state laws did not permit the railway company to legally engage in the gravel business commercially. Therefore, it caused the Alpena Gravel Company to be incorporated and leased its gravel pit and equipment to the new company for $1 per year, and thereafter, by operating through this new organization, continued to produce and sell gravel.

The greater part of the gravel marketed by the Alpena Company was sold below cost of production, but this loss was compensated by the freight revenue received by the railway company incident to the shipments.

Furthermore, the railway company manipulated freight rates in favor of the Alpena Company, supervised and directed the operation of that company, furnished lumber to it, maintained and improved its plant. The deficit resulting from this manner of conducting the gravel business was, from time to time, paid by the railway company under the guise of a purchase and payment for ballast, but such payments were far greater than the market price of the ballast.

The Federal Gravel Company had established a prosperous business but, because of the methods of carrying on the business of the Alpena Gravel Company, the former was not able to withstand the competition and was compelled to close its plants. Therefore, the Federal Gravel Company filed suit against the railway company. It is interesting to observe that the Court thus indicated the liabillity of the railway company and said:

"While the Alpena Gravel Company is alleged to be a 'dummy corporation,' it in fact is a legal entity entirely separate from the railway company and, for the purpose of this case, must be treated as such, notwithstanding its incorporation may have been prompted in part by a desire and by an intention of those interested to use it as a device to accomplish an illegal purpose. It has been held by highest authority that any device by which the freight rate is reduced below the rate given in the published schedule is one for giving a rebate. . . . By charging a less rate to plaintiff's (Federal Gravel Company's) competitor in the gravel business, the same relative financial disadvantage is suffered by the plaintiff as would have been experienced by it had the plaintiff been required to pay an excessive freight rate to the railroad company. The damage sustained by a shipper in consequence of paying excessive freight rates can be recovered by an original suit instituted in the Courts of this state."

Must Comply With Legal Requirements to File Suit

Few persons realize the importance of complying with the state laws which require individuals, partnerships and corporations to comply with certain regulations before a suit is filed to recover money due for merchandise. Almost all states have enacted laws which require persons operating under fictitious firm names not disclosing the true names of the persons interested as partners, to file a certificate containing such information with the clerk of the county in which the business is located.

For example, in Wetenhall v. Chas. S. Mabrey Const. Co., 280 Pac. 391, a seller of rock named Wetenhall, operating his business under the firm name of W. S. Wetenhall Company, filed suit against a purchaser to recover money for material furnished in the construction of a building. The purchaser attempted to avoid liability on the grounds that Wetenhall had not filed the required certificate with the county clerk. However, since Wetenhall was the *sole* member of the firm, the Court held the purchaser liable for payment, saying:

"The first question, therefore, to be determined is whether the name 'W. S. Wetenhall Company' is a fictitious name. . . . If the name 'W. S. Wetenhall Company' is not fictitious, then he . . . is an individual doing business under the name and style of 'W. S. Wetenhall Company,' and is not a partnership. . . . We have been unable to discover any case in which a single individual who was doing business under the name not his own, but one which was not fictitious, was required to comply with said law, before he could maintain an action, notwithstanding, from the name used alone it might be impossible to determine how many persons were interested in the business."

Authority of President of Corporation

Contrary to the opinion of the majority of persons a president may not legally bind the corporation, except in accordance with the provisions of the by-laws, or by authority of its directors, or **custom.**

For instance, in First National Bank v. Cement Products Co., 227 N. W. 908, it was disclosed that the Cement Products Company accepted from a purchaser notes aggregating $45,000. It sold these notes to a bank. At this time the president of the cement company agreed in writing with the bank that the cement company "shall protect and save harmless and be and remain liable on promissory notes purchased" by the bank.

The articles of incorporation of the Cement Products Company provide that the business thereof shall be managed by a board of directors, and neither the articles nor the by-laws authorized the president to enter into or execute contracts of the character here involved in its behalf. Also, since only one witness, the manager of the cement company, testified that he was informed of the agreement and the directors had **not** authorized the president to obligate the corporation in this manner, the Court held the corporation not bound by the president's agreement, and explained the law, as follows:

"'It is well settled that the office of president of a corporation in itself confers no power upon him to bind it by contract. His power must be determined by the organic law of the corporation or by delegation of authority by its managing officers or be implied from the habit or custom of transacting the business of the corporation. . . . Except for the statement of the witness King, that he heard talk of the agreement, there is nothing to show that the corporation knew of the transaction."

TRAFFIC NEWS AND COMMENT

Mica Scrap and Mica Ore

C. F. A. Docket No. 24,120 contains proposal to establish on mica scrap and mica ore, waste or crude carloads minimum weight 50,000 lb. from Sixteen Island, Que. to Chicago of 32c per 100 lb. Present rate 66c.

Sand and Gravel

Docket No. 24,111 of the C. F. A. proposes rates on sand and gravel carloads from Lafayette, Indiana to various destinations in Illinois and Indiana.

The proposed rates to a few of the destinations involved are as follows, per ton:

	Sand	Gravel
Chicago Heights, Ill.	$0.90	$0.98
Danville, Ill.	0.80	0.80
Terre Haute, Ind.	1.15	1.15
St. Anne, Ill.	0.90	0.94

Present rates are on classification basis.

Cement

Southern Freight Association Docket No. 49,294 proposes rates on cement from Kosmosdale, Ky. to upper Mississippi River crossings when destined beyond. This involves reduction of the present rate to 16½c to E. Hannibal, Quincy, E. Keokuk, E. Burlington, Rock Island, Savanna, E. Clinton, and E. Dubuque, Ill. The proposed rate is said to be in relation to the rate from Speed, Indiana.

Core Sand

Central Freight Association Docket No. 24,076 proposes establishment of rates on core sand carloads from Kankakee, West Kankakee, Greenwich and Van's Siding, Ill. to points in Indiana and Ohio.

A few of the destinations involved are listed below with the present rates per cwt. and proposed rates per ton:

	Present Rate	Proposed Rate
Alexandria, Ind.	$ .18	$1.70
Decatur, Ind.	.19½	1.80
Ft. Wayne, Ind.	.18	1.80
Muncie, Ind.	.18½	1.80
Cincinnati, Ohio	.21½	2.10
Dayton, Ohio	.22	2.20
Springfield, Ohio	.22	2.20
Middletown, Ohio	.22	2.20

Feldspar

In Docket No. 24,079 the Central Freight Association will consider establishment of rate of $4.10 per ton on feldspar carloads minimum weight 50,000 lb. The present rate is $3.45 per ton.

Crushed Stone Coated with Oil, Tar or Asphaltum

Central Freight Association Docket No. 24,092 involves rates on crushed stone, coated with oil, tar, or asphaltum, known as amesite or carbo-rock, carloads from Buffalo, N. Y. to various points in Pennsylvania, New York, and Ohio.

A few representative points, with the present rates per 100 lb. and the proposed rates per ton are given.

	Present Rate	Proposed Rate
Cleveland (E. 105th St.) Ohio	$ .20	$1.99
Franklin, Pa.	.17	2.11
Falconer, N. J.	.13½	1.30
Westfield, N. J.	.13½	1.19

Crushed Stone

I. C. C. Docket No. 23,162 covers complaint filed by the United States Graphite Company in which it is alleged that the sixth class rate of $0.23½ is excessive, unreasonable and unjust, both relatively and per se on shipments of crushed stone, carloads, from Joliet, Ill. to Saginaw, Mich.

The establishment of a rate not to exceed $2.30 per ton and reparation is asked for.

Silica Sand

In I. & S. Docket No. 3,335 the I. C. C. has found proposed increased rates on silica sand from the Ottawa district in Illinois to Marion, Ohio, and points on the Erie R. R. between Marion and the Indiana-Ohio state line not justified.

The suspended tariff schedules are ordered cancelled and the proceeding discontinued.

Gypsum

The Blue Diamond Company has filed complaint with the I. C. C. which has been assigned Docket No. 23,168.

The complaint is against carload rates on gypsum from Arden, Nev. to Monolith, Calif. which is alleged to be excessive, unreasonable and unjust.

The complaint also refers to rates between other points in the same general territory and seeks the establishment of just and reasonable rates and non discriminatory relationship of rates.

New Firm Furnishes Technical and Commercial Advice

A new sort of commercial service is offered by Wadleigh and Bailey, Southern Building, Washington, D. C. This new firm will furnish clients dependable advice or correct information on any technical, statistical, economic or commercial subject in connection with the extraction, processing, sale, manufacture, distribution or use of any product of the mining, mineral extractive or chemical industries; and personal representation in the National Capital in connection with any matters involving conferences or negotiations with governmental agencies.

Mr. Wadleigh is a consulting engineer and trade promotion authority of exceptionally wide experience whose governmental connections have been of a character which afforded unusual information as to records and files. During the war period he served in the Central Bureau of Planning and Statistics. Mr. Bailey is a mining and management engineer and seasoned business executive who for a number of years was responsibly connected with the mining subsidiaries of Allied Chemical and Dye Corporation.

Central-Mixed Concrete Approved by Philadelphia Bureau

The Warner Company has received, from the Philadelphia Bureau of Building Inspection, official approval of the company's central mixed concrete for use in building construction in Philadelphia. This approval of concrete mixed at a central plant and delivered in liquid form to the site of building construction is regarded in the building trades as of far-reaching importance. Action by the Bureau is the result of exhaustive tests made under its supervision and is contingent upon compliance with certain definite requirements laid down by the Bureau. In these tests the Bureau was represented by George Warner, concrete engineer, and Prof. H. L. Berry of the University of Pennsylvania. The tests were made in the construction of a building which was especially designated by the Bureau for this purpose.

Leffel Company Moves Minneapolis Office to Chicago

James Leffel & Co., Springfield, O., manufacturers of hydraulic turbines, has moved its Minneapolis, Minn., office to Room 444, 20 N. Wacker Drive, Chicago, Ill.

INSURANCE PROBLEMS DISCUSSED

Surety Bonds

What is the difference between a surety bond and an insurance policy? Both are contracts issued by insurance companies. Bonds and policies alike call for a small annual premium in return for which the insurance company guarantees the beneficiary against financial loss in the event of some unknown future disaster.

In the case of policies the insurance company agrees to pay a direct indemnity for every loss. It is "stuck" immediately. In the case of bonds, however, the liability of the insurance company is indirect or secondary. When loss occurs the "principal" (the individual or firm which gave the bond) must pay first and the insurance company merely stands to make up his deficiency or failure.

In our industry we are mostly concerned with two types of bond—the contract bond in connection with supply or construction work, and the fidelity bond which furnishes indemnity for dishonesty on the part of an employe.

Political Influence

Most of us have had experience in giving surety bonds on contracts covering building construction or the supply of materials. Such bonds are always demanded for public jobs (state, county, schools, etc.) and are becoming common on private work. Some contractors follow the path of least resistance in getting bonds and do not give much thought to the problem. Rates and forms are identical for most of the large insurance companies. On the other hand many local politicians and architects try to control the placing of bonds, either for personal profit or to help a friend. Commonly pressure is brought on the contractor with the implication that his chance of getting the job will be increased by offering the bond to the favored insurance man.

While this custom of using contract bonds to build good will is somewhat compulsory, you should always try to keep your bonds with your regular agent or broker. Even though rates may be uniform, there are important differences in the treatment you may get from insurance companies. If something goes wrong while a contract is being performed, it makes a big difference to you whether the bonding company is cold-blooded in "squeezing" you to protect itself or whether it will cooperate with you, as it probably would on the advice of your agent. Also your own company already knows your business standing. It can issue bonds promptly without "red tape," while any other company must take both the time and bother to investigate your resources and credit. These factors are important enough to warrant your putting the bonds with your own insurance agent wherever possible.

Fidelity Bonds

The second big class, fidelity bonds, covers losses due to the dishonesty of employes. As was pointed out in connection with forgery bonds, not all embezzling is done by the youngest and newest clerks. Reverses in speculation, a new desire for some luxury (such as an automobile or radio) or even a severe and expensive illness in the family—any of these may tempt an old and faithful employe to cheat his firm. Living conditions change constantly and all of your workers, new and old, are susceptible to the moral risk of a distorted point of view. Embezzling is done not by professional criminals but by ordinary citizens who just slip bit by bit, being driven from one deceit to another in an effort to "cover up their tracks."

Positions of Trust

The rule of intelligent business men is to bond all employes in positions of trust regardless of who they are. By making this a general rule you do not offend any employe, because it is obvious you are following a business principle and are not suspecting any individual of dishonesty. Incidentally, this bonding idea is a good preventive measure. The bond company usually makes a personal financial investigation of all applicants and you will find out if it discovers anything irregular about your men. There is also an unconscious moral pressure or fear in a bond. The employes know that a big insurance company, as well as the boss, is interested in their integrity, and that the insurance company has plenty of money and experience at its disposal to trace down dishonesty.

Whom to Cover

It is important to understand which employes should be put under bond. Obviously anyone who handles large sums of money, as the cashier or paymaster, has opportunities to get away with something. And any bookkeeper or auditor may involve his firm through crooked accounts. It is just as true, though not so well known, that salesmen and shipping clerks can conspire with your customers' employes to put through fraudulent transactions, and that the biggest losses are caused by downfallen executive officers, such as treasurers, superintendents and vice-presidents. All employes who handle money, books or merchandise, or who have authority to act for your firm on contracts or purchases, are in a position to perpetrate embezzlement and should be bonded on the grounds of common sense safety and usual business custom.

As in the case of contract bonds there is little variation in rate between different insurance companies and in the form of bond covering individual employes. However, if you propose to bond at least six men for an aggregate amount of $30,000 you are entitled to a special rate and a "schedule" form. A schedule bond may include several valuable special provisions. For example, instead of covering your staff by name, it may cover any incumbent of certain positions, such as cashier or receiving clerk. This saves the need of remembering to notify the insurance company whenever you change help. The modern fidelity bond, therefore, can be fitted to every firm's requirements and to cover every variety of dishonest act.

Cement Production for January, 1930

American portland cement mills continue to show a decline in the ratio of operations to capacity as indicated by the figures for 12 months' period ending January 31. According to statistics released by the Bureau of Mines of the Department of Commerce, the ratio of operations to capacity for the last twelve months was 65.5 per cent. The ratio percentage for 12 months ended January 31, 1929, was 71.0 per cent, and has fallen from a maximum of 71.1 per cent for twelve months ended April 30 to 65.5 per cent for 12 months' period ended January 31, 1930.

During the month 8,498,000 barrels were produced, 4,955,000 barrels were shipped, and stocks on hand at the end of the month were 27,094,000 barrels. Production for January 1930 was 14 per cent less and shipments 13.2 per cent less than January 1929. Stocks at the mills were 1.1 per cent higher than a year ago.

REVIEW OF FOREIGN PRACTICE

Action of Sulphates on Portland Cement

Two articles have been published up to the present in a series contributed by T. Torvaldson, D. Wolochow and V. A. Vigfusson, all of the University of Saskatchewan, to the *Canadian Journal of Research*, dealing with the action of sulphate solutions on the properties of portland cement mortars and concretes. The first article, in the September issue (Vol. 1, pp. 273-284), describes the use of the expansion method of studying the sulphate action, this method avoiding one of the chief disadvantages of the tensile and compressive strength method—the necessity for using a very large number of specimens, for in the expansion method a test piece can be used as long as the action of the sulphate leaves it intact. This paper presents experimental data dealing with the reproducibility of the expansion measurements, the relation between expansion and loss of tensile strength, and results obtained with standard sand mortars of varying richness of mix. Strict reproducibility of the time-expansion curve can not be expected because of variations in the swelling of colloidal gel formed mainly from the calcium silicates through hydrolysis or hydration, and in the formation of crystals of calcium sulphoaluminate and calcium sulphate in the mortar, both of which are advanced as causes of the expansion under sulphate action. The expansion-strength curve is not linear, the tensile strength diminishing at a decreasing rate with respect to expansion. The tests on the mortars of different richness of mix show that the resistance of the mortar increases with increasing richness of mix.

A second article in the October issue (1:359-384) discusses a study of the effect of steam curing at various temperatures between 50 deg. and 200 deg. C. on the resistance of portland cement mortars to the action of solutions of the sulphates of sodium, magnesium and calcium. The methods used consisted in comparing the expansion of steam-cured and of untreated mortar specimens during exposure to the solutions, and in determining the changes in the tensile strength of the more resistant mortars after long periods of exposure. The conclusions drawn from these investigations were: (1) Curing in water-vapor at temperatures below 100 deg. C. is of doubtful value on account of the loss in strength occurring during treatment; at a temperature of 50 deg. it decreases their resistance to the action of sulphates. (2) Steam curing at 100 deg. C. for 24 hours or more very materially increases the resistance of the mortar to the action of sulphates. The expansion of the specimens in solutions of sodium and calcium sulphate may thus be reduced to very small proportions, and the loss of strength greatly delayed. In solutions of magnesium sulphate the expansion is retarded, and the specimens gain strength as the volume increases up to a critical point at which they begin to develop cracks and lose their strength. The deterioration of the mortar is thus due mainly to gradual loss in strength in solutions of sodium sulphate and calcium sulphate, and to gradual increase in volume in solutions of magnesium sulphate. The steam treatment at 100 deg. C., however, produces mortars of low tensile strength. Therefore, while treatment may increase almost indefinitely the life of a specimen exposed to solutions of sodium and calcium sulphate under laboratory conditions, and increase the life of specimens exposed to solutions of magnesium sulphate to from 10 to 100 times that of untreated mortar, steam-cured specimens are likely to fail when exposed to high concentrations of sulphates under severe climatic conditions. (3) The disadvantage of low tensile and compressive strength in steam-cured mortar or concrete may be entirely avoided, and material of much higher resistance to sulphate solutions obtained, by curing in steam under pressure at 125 to 175 deg. C. for 24 hours or more.

Tests on Hungarian Bauxite Cement

Bauxite cement (high alumina cement) is produced in Hungary by the Tataer cement plant under the name "Citadur," which was put on the market during 1928. It is a slow-setting cement of high initial strength, the strength at 2 or 3 days reaching or passing that of portland cement at 28. Its resistance to chemical action is greater than portland cement. Because of these generally recognized properties, the Hungarian state railway laboratories made a series of tests on the Citadur cement to determine just where it was practical for use in railroad work. The composition of the cement is: insoluble 2%, loss on ignition 0.3%, SiO_2 4.32%, Al_2O_3 42.25%, Fe_2O_3 14.11%, CaO 36.82%, MgO 0.11%, SO_3 0.54%. The percentage retained on a 900 mesh per sq. cm. screen (75 mesh) is around 0.1%, and that on 4900 mesh per sq. cm. (175 mesh) 3%. Setting begins at 4 h. 20 min. to 5 h. 50 min. in air and 5 h. to 5 h. 45 min. under water, and ends at 6 h. 30 min. to 6 h. 50 min. in air and 6 h. 10 min. to 6 h. 35 min. under water. The resistance to chemical action, especially sulphate and chloride solutions and organic acids, is considerably greater than portland cement. The Citadur is very sensitive to admixtures of lime or portland cement; with a few per cent of lime or portland cement (or the admixture of Citadur to portland), the mix becomes rapid-setting. Tests are now in progress on expansion and contraction and on properties of elasticity. In the comprehensive strength tests the bauxite cement in 1:3 mortar with Vienna standard sand developed 512 kg/cm² at 1 day, 597 kg. at 3 days, 675 kg. at 7 days and 720 kg. at 28 days, as contrasted with corresponding results for portland cement of 207, 420, 553 and 619 kg/cm²; similar tests substituting a properly graded Danube sand for the standard sand gave, for the Citadur 1:3 mortar, 889 kg/cm² at 1 day, 932 at 3 days, 877 at 7 days and 1077 at 28 days, and for the portland cement mortar 116, 420, 745 and 833 kg/cm², respectively; similar results were obtained in the tensile tests. Another series of tests using mortars of different mixes brought out the interesting result that approximately equal strengths at 7 and 28 days are obtained from 1:5 Citadur mortar and 1:3 portland cement mortar, although the cement consumption is considerably smaller for the Citadur (381 kg. of cement per cubic meter as against 580 kg. for the portland). Citadur is about 50% more expensive than the portland cement available in Hungary, and the author concludes that its use is justified only in cases where the time saved in construction has an economic value offsetting its higher cost, and for work where its higher strength and greater resistance to chemical action are essential. Because of its greater strength, its use also makes possible smaller proportions for certain concrete structures with an equal factor of safety.—Eugen Kiss in *Organ f. die Fortschritte des Eisenbahnwesens*, (Munich) 84:376-378, Sept. 20, 1929.

LATEST NEWS FLASHES

Morris Machine Works Moves Chicago Office

The Morris Machine Works has changed the address of its Chicago office to Room 716, Builders Bldg., 228 N. La Salle St. The office is in charge of F. S. Salchenberger.

Volunteer Portland Secures Large Contract

G. O. Head, representing the Volunteer Portland Cement Company, of Knoxville, Tenn., has just closed a contract to furnish the State Highway Commission, at Raleigh, N. C., with 200,000 barrels of cement for use in highway construction in North Carolina. The amount of the contract totals approximately $500,000, according to advices received here.

Canadian Annual Production of Sand and Gravel

Production of sand and gravel in Canada in 1929 established a new high record when 28,102,917 tons valued at $5,809,431 were produced. This compares with 22,952,819 tons worth $6,055,501 in the previous year. In rough percentages, the output was 22 per cent greater than in the previous year and the valuation was 4 per cent lower than the 1928 figure.

Imports of sand and gravel in the year under review amounted to 588,211 tons appraised at $375,322, of which 585,885 tons came from the United States, 2,176 tons from Belgium and minor quantities from other countries. Silica sand imports totaled 154,384 tons valued at $332,338, of which 121,578 tons came from the United States, 27,783 tons from Belgium, 5,023 tons from the Netherlands and a minor shipment from the United Kingdom. Exports of sand and gravel during the period under review totaled 797,111 tons, with a valuation of $232,422.

Du Pont Technical Men Hold Meeting

The fourteenth annual meeting of the Technical Section of the Explosives Department, E. I. du Pont de Nemours & Company, was held in the du Pont-Biltmore Hotel, Wilmington, Del., February 4, 5 and 6. Arthur LaMotte, manager of the section, presided. More than one hundred subjects relating to explosives and their uses in mining, construction and for other industrial purposes were discussed by the eighty du Pont executives and field representatives from all parts of the United States.

J. W. McCoy, general manager of the Explosives Department, addressed the opening session, while L. P. Mahony, director of sales, was the principal speaker at the dinner which followed the close of the three-day meeting.

Easton Car & Construction Co. Announces Seattle Agency

A. H. Cox & Company, general machinery dealers, 1757 First Ave., South, have been appointed as the exclusive agents for western Washington of the Easton Car & Construction Co.

Model Dredging Unit Exhibited at Sand and Gravel Convention

The annual convention of the National Sand and Gravel Association held recently at Memphis, Tenn., featured a number of very attractive exhibits of equipment used in the production and handling of sand and gravel. One of the most interesting of these, and one which attracted a good deal of attention, was the exhibit of the Morris Machine Works, of Baldwinsville, N. Y.

The exhibit consisted of a complete miniature dredge installation on a one-eighth scale with a miniature 12-inch Morris centrifugal pump, a three-drum hoist and a screen nozzle ladder agitator over the intake. Each of these units was operated by an individual electric motor and controlled in the same manner as a full-size unit. Sand and small pebbles were actually dredged out of a large box, the discharge feeding the material back into the box.

Chicago Pneumatic Opens Tulsa Office

Chicago Pneumatic Tool Co., New York, announces the opening of a branch office at 327 Philcade Bldg., Tulsa, Okla. George J. Lynch has been appointed district manager in charge of this office and the territory it serves. This office will handle all details of the sale and servicing of compressors, engines, pneumatic tools, electric tools, vacuum pumps, condensers and rock drills. This company recently opened an office and service station at 1 West 16th Street, Oklahoma City, Okla., for exclusively handling the CP Tucone rock bit, and that office will continue.

Mechanical Engineers to Celebrate Semi-Centennial

Mechanical engineers throughout the country are interested in the unusual type of celebration that is to be conducted by the American Society of Mechanical Engineers early in April. Sessions of this event, which will be the Fiftieth Anniversary, are to be held in Washington, Hoboken, and New York.

One of the exhibits which attracted a great deal of attention at the recent convention of the National Sand and Gravel Association

The leading scientific and engineering societies and educational institutions throughout the world have been invited to send two delegates each to the celebration. Similar invitations have been extended to the leading trade associations and trade schools of the United States.

The actual celebration of the Fiftieth Anniversary will begin on April 5 in New York, where the delegates, members, and guests will register at the United Engineering Societies Bldg., 29 West 39th Street.

Reeves Brothers Company Changes Name

On February 15 the Reeves Brothers Company became the A. G. Reeves Steel Construction Company. No change in corporate structure or organization was involved.

Tractor Manufacturer Disclaims Rumor

The Linn Manufacturing Corp., a division of La France-Republic Sales Corp., states that there is no foundation for a recent rumor that it is interested or contemplating any connection with any particular make of power shovel.

Platform Scale Attains Its Centenary

The ordinary weighing device known as the platform scale had its inception just one century ago. It is said that Thaddeus Fairbanks, of St. Johnsbury, Vt., built such a scale in 1830 for the specific purpose of weighing hemp. Fairbanks, Morse & Co., the present-day successors of the original Fairbanks Brothers, state that the original design of the platform scale has remained fundamental and that all scale manufacturers build along the same general lines.

Fuller's Earth Refinery To Be Enlarged

The Acme Manufacturing Co., Cleveland, O., expects the completion, by April 1, of its $75,000 enlargement of its fuller's-earth refinery at Midway, Fla., says *Jasper* (Fla.) *News*.

Amendment to Lime Industry's Trade Practice Rules

The Federal Trade Commission has announced a simple amendment to the wording of Rule 6, Group I, of the rules for the lime industry. In the rules as finally approved, Resolution 9 of the preliminary draft considered last June at the annual meeting of the National Lime Association became Rule 6 (see page 42 PIT AND QUARRY, July 17, 1929). As amended, Rule 6 reads, "To violate the provisions of the Act of Congress approved August 23, 1916, Pub. No. 228, 64th Congress, entitled, 'An Act to Standardize Lime Barrels,' is an unfair trade practice." The change omits the words "in all transactions."

American Aggregates Complains to Utilities Commission

Concessions allowed by the New York Central Railroad to competing concerns forms the basis of a complaint filed with the Ohio Public Utilities Commission. The case will be heard March 18.

Beaver Portland Cement Resumes Operation

The plant of the Beaver Portland Cement Co. of Portland, Ore., has been put into operation after being closed down for several months. The company reports the heaviest business in its history for this season of year. The company has plans for a hydro-electric power plant on Rogue River to serve its cement plant at Gold Hill, Ore.

General Crushed Stone to Open New Plant in Woburn

The completion of the asphalt plant by the General Crushed Stone Co., which is expected about May 1, will bring a new industry to Woburn, Mass. The plant, which will be made up of large tanks and mixing compartments, will produce asphalt, road-dressing, cold mixtures and other tar and rock products used in road construction and repair work. The plant will employ about 30 men, when operating to capacity, and the capacity operation of the plant is not an impossible thing during the coming year.

Refractories Manufacturers Adopt Code of Business Ethics

American Refractories Institute has published a pamphlet containing a code of ethics which was prepared and adopted in an effort to eliminate unfair trade practice, unfair competition and economic waste which exist in the refractories industry and which have resulted disastrously to manufacturer and customer alike.

This code covers discounts and credits, rebates, misbranding, service guarantees, type and validity of contract, proposals, commissions, dealers, breakage claims, commercial bribery, brands and trade-marks, and general practices.

Broderick & Bascom Rope Company in New St. Louis Office

The Broderick & Bascom Rope Company recently took possession of its new office and warehouse building, adjoining the St. Louis factory. Three times between 1876 and 1897 the company moved its office and warehouse to successively larger quarters. In 1897 it moved into the "nucleus" of its recently vacated location on North Main Street. The company operates another large and productive factory in Seattle, Wash., to serve West Coast industries. It also maintains large stocks in its New York, Portland, and Houston warehouses.

Feldspar Grinders' Institute Elects New Officers

The following officers were elected at the first annual meeting of the Feldspar Grinders' Institute held on Friday, February 21, 1930, at the New York Athletic Club: H. P. Margerum, Consolidated Feldspar Corp., president; C. H. Peddrick, Jr., United Feldspar Corp., vice-pres.; Herreld D. Thropp, Eureka Flint & Spar Co., vice-pres.; James Turner, Trenton Flint & Spar Co., vice-pres.; L. L. Hunt, Bedford Mining Co., secy.-treas.

The above, with the following, are the directors of the Institute: Richard Wainford, Trenton Flint & Spar Co.; Norman G. Smith, Main Feldspar Co.; H. G. McLear, Green Hill Mining Co.

Distributors Recently Appointed by Trackson

Among the new distributors which have been appointed recently to handle Trackson tractor equipment for McCormick-Deering tractors is the J. D. Adams Company, Indianapolis, Ind., which will cover the territory included in the Indianapolis, Fort Wayne, Richmond, Terre Haute and Evansville, Ind., branches of the International Harvester Co., and also that of the Louisville, Ky., branch.

McCarthy-Jones & Allen Co., Inc., Nashville, Tenn., has been appointed Trackson distributors for the Nashville Territory, and the Option Equipment & Supply Company, Mt. Oliver Station, Pittsburgh, Pa., for the Pittsburgh territory.

Steel Company Consolidation Elects Officers

At the stockholders' meeting of the Sivyer Steel Casting Company, of Milwaukee, recently consolidated with The Nugent Steel Castings Company,

of Chicago, the following officers were elected: C. R. Messinger, chairman of the board; L. S. Peregoy, president; M. A. Fladoes, vice-president in charge of sales; George L. Pollock, secretary, and C. A. MacDonald, treasurer.

The directors are: C. R. Messinger, W. C. Frye, Walter Kasten, Donald Fraser, C. F. Messinger, E. L. Wood, L. S. Peregoy, C. A. MacDonald, M. A. Fladoes, and C. E. Stone.

Phosphate Plant Assured at Nampa, Idaho

The Idaho-American Phosphate Company has purchased a site in Nampa, Ida., and will erect a small plant which will produce a fertilizer element from the Idaho deposits of phosphate rock.

National Equipments Acquires Another Company

The National Equipment Corporation, Milwaukee, Wis., announces the addition to its group of the C. H. & E. Manufacturing Co., 254 Mineral Street, Milwaukee, manufacturers of saw rigs, pumps, hoisting machinery, material elevators, and mortar mixers.

The C. H. & E. Mfg. Company was founded in Milwaukee in 1909 by Mr. Frank F. Hase, president, and others. The National Equipment Corp., which became an operating company on January 1, 1930, includes the Koehring Company, manufacturer of pavers, mixers, power shovels, cranes, draglines, and dumptors; the Insley Mfg. Co., of Indianapolis, manufacturer of excavators and concrete placing equipment; the Parsons Company of Newton, Iowa, producer of power trench excavating machinery; the T. L. Smith Company of Milwaukee, manufacturers of mixers, pavers and Weigh-Mix; the C. H. & E. Mfg. Co., and the Kwik-Mix Company of Port Washington, Wis., manufacturer of small concrete mixers.

Mr. Hase becomes vice-president and director of the National Equipment Corporation.

National Company Improves Two of Its Ohio Plants

National Lime and Stone Company plans to construct a new plant at its Bluffton, O., quarry to replace the one that was destroyed by fire last September. It will be smaller than the old plant and intended to supply local demands only. Construction is expected to be completed about next November.

The company is also making improvements in its plant at Arlington, O., which will double the capacity.

Easton Car Moves New York Offices

The Easton Car & Construction Company announces that the new address of its New York Office is now located at No. 10 East 40th St. Phone Ashland 3171, and requests that all interested in the office records correct their records so that all mail in future instances be addressed to the new address.

American Cement Resumes Operations at Security

The plant of the American Cement Corporation, at Security, Md., which was closed down for six weeks, has resumed operations. The company spent $60,000 in improvements which include a hammermill.

Electric Machinery in New Detroit Office

Electric Machinery Mfg. Co. announces that the new location of its Detroit office is 10-230 General Motors Building.

Combustion Engineering Moves Hazelton Office

Combustion Engineering Corporation, New York, announces the removal of its Hazelton, Pa., representative, the Coxe Stoker Engineering Company, to its new quarters, Room 109, Markle Bank Building.

Peerless-Egyptian Reports Increased Business

Albert A. Oesterle, superintendent of the Peerless-Egyptian Cement Company, is quoted by the *Port Huron* (Mich.) *Times* as stating that the local plant will start, April 1, on the monthly-production basis of 100,000 barrels.

Southern Feldspar Operates Night Shifts

To meet the increased demand for its ground products, the Southern Feldspar Company has been forced to operate its small plant at Toecane, N. C., continuously, day and night. The treated feldspar is sold to potteries.

Ohio River Gravel to Be Dredged at Mt. Vernon, Ind.

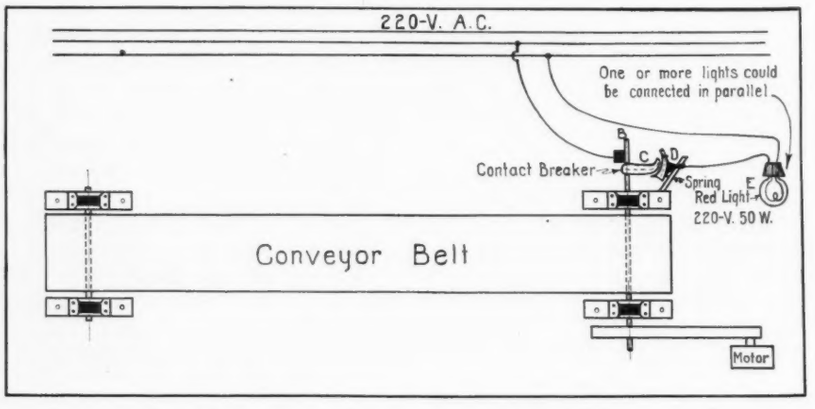
George J. Thomas, of Mt. Vernon, Ind., has purchased equipment for dredging sand and gravel from Ohio River on a small scale.

Functioning of Conveyor Indicated by Homemade Device

The utilization of electric lights as signals that machinery is, or is not, functioning properly has been adopted in numerous ways in various kinds of industrial plants. This scheme is used in the plant of the Fort Worth Sand and Gravel Company, described in this issue of PIT AND QUARRY. George Strozut, an employe of the Oregon Gravel Company, Salem, Ore., sends us a sketch of a device which he installed to indicate, from a distance, whether or not a certain conveyor is operating, and which was proved an economy in both physical energy and cash.

Ordinary electric current passing through contact brush *A* charges the extended shaft *B* and contact breaker *C* which contacts with the stationary segment *D* once each revolution, thus causing the light bulb *E* to glow.

Several lights may be connected in parallel at convenient stations about the plant. This particular conveyor handles graded crushed rock and is so located that it cannot be seen from any distance. The device might be attached at either end of the conveyor. Mr. Strozut estimates that this little mechanism saves him about 600 miles of walking per year, and that it means a saving of about $400 per year to the company.

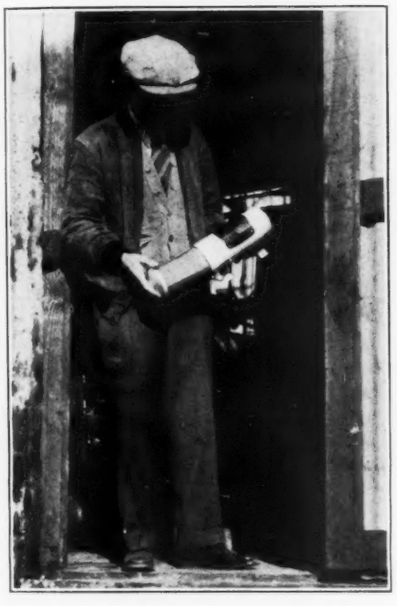


Home-made Device for Indicating Operation of a Conveyor

NEW MACHINERY AND SUPPLIES

A First-Aid Kit

Bullard-Davis, Inc., manufacturer and distributor of safety equipment, announces that it has been appointed by the Standard Oil Company of California as licensed manufacturer of the Standard Oil patented aluminum first aid kit. The kit will be placed on the market under the name Bullard Cylindrical First Aid Kit. It is, as its name implies, cylindrical in shape and is made of drawn aluminum. It can be conveniently mounted on a wall and makes an ideal kit for trucks or any kind of motor vehicle. This fact makes it possible for a company to



Aluminum first-aid kit

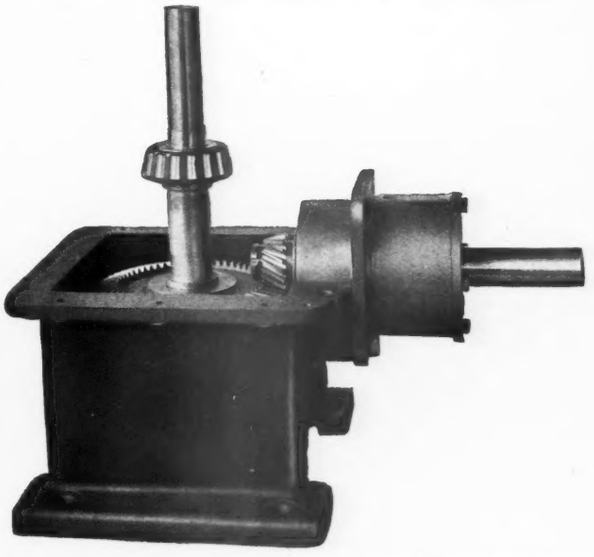
standardize on one type of kit for all purposes. The kit is durable, dustproof, waterproof, non-corrosive and non-tarnishing.

Within the Bullard Cylindrical Kit the first aid material is kept in unit packages rolled in a durable duck roll-up. The roll-up is easily removed from the kit and can be carried conveniently to the injured man. The visibility of just what the kit contains and the simplicity of removing the desired units eliminates the necessity of fumbling in time of excitement. The roll-ups are easily and conveniently carried from place to place. This simplifies and speeds up the job of maintaining the kits in complete working order.

Spiral Bevel-Gear Right-Angle Speed Reducer

A new type right-angle speed reducer consists of spiral bevel gears mounted on Timken roller bearings. This new line includes both horizontal and vertical types with slow-speed shaft extended either upward or downward.

Ratings range from ¼ hp. to 100 hp., with ratios 1:1 to 6:1. Larger reductions are obtained by the combination of the spiral bevel gear and planetary spur gears with ratios 8:1 to 1600:1 or more. The gear teeth and bearings are lubricated by the splash system.



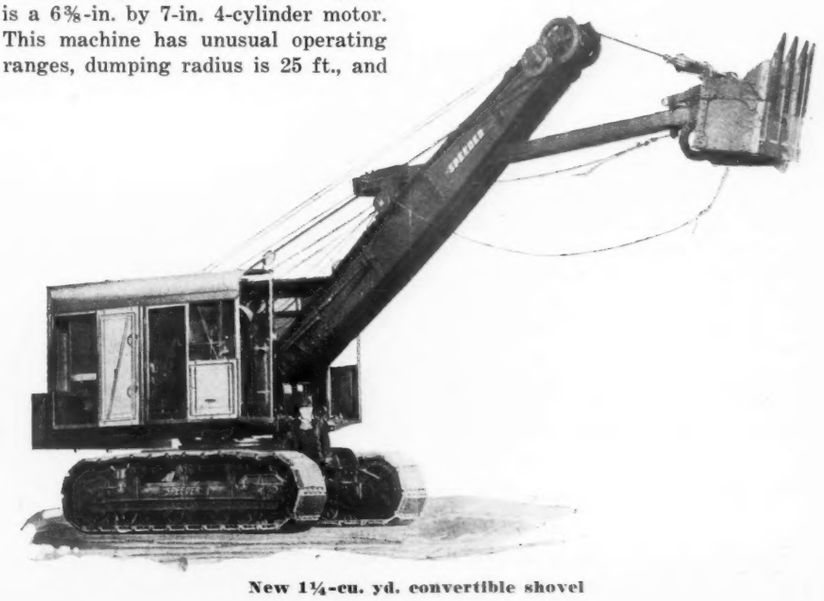
Right-angle spiral bevel gear speed-reducer, "vertical type"

This speed reducer is manuafctured by D. O. James Manufacturing Co., 1114 W. Monroe St., Chicago.

An Improved Convertible Shovel

The Speeder Machinery Corporation has recently developed and has just announced a new Speeder Model 90 1¼-cu. yd. convertible shovel. This machine is said to be a development designed in accordance with tested and approved engineering principles by engineers of long and highly successful experience in the field of shovel design, built for heavy duty and to automotive standards of machine shop practice. The power plant is a 6⅜-in. by 7-in. 4-cylinder motor. This machine has unusual operating ranges, dumping radius is 25 ft., and has a dumping height of 16 ft. at 45 deg. It has exceptional speeds of 145 to 180 f.p.m. All shafting is high alloy, heat treated and ground to size. All important moving parts operate on Timken bearings and have Alemite lubrication.

According to the manufacturer this model was designed to fill a demand created by the successful operation of the ½-cu. yd. Speeder. The same principles involved in that machine have been incorporated into the new model, which is intended to meet the particular need of those who desire a larger machine with the same speed and ease of operation as the ½-cu. yd. machine.

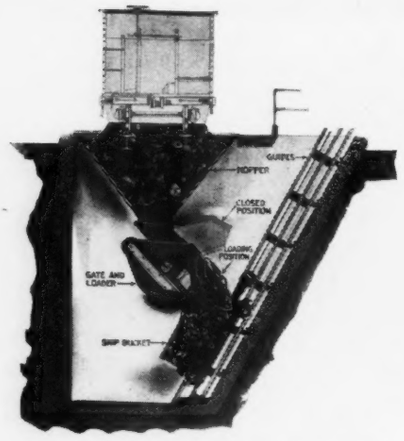


New 1¼-cu. yd. convertible shovel

New Automatic Loader For Skip Hoists

Link-Belt Company announces the addition of a new type to its line of automatic loaders, for the proper loading of skip-hoist buckets with coal, coke, ashes or stone. The new loader is known as the full-bucket-control type and has been thoroughly tried out in actual service. It has a simple attachment, which consists of a swinging plate so arranged that, unless material is flowing through the chute in sufficient depth to maintain electrical contact, the hoist will not operate. In other words, there has to be sufficient material in the hopper to fill the bucket. When the bucket reaches the loading position the loader permits the material to flow from the hopper until the bucket is full, when the mechanism instantly causes the bucket to be hoisted, thereby moving the loader into its closed position, where it remains as the bucket continues to travel to the emptying point, and until bucket returns to the loading position, where it is again automatically loaded. The bucket continues to load and empty automatically so long as there is sufficient material to fill it.

The new loader is protected by patents (granted and pending) and is covered by the new Skip Hoist Catalog No. 946, which has 48 pages, is copiously illustrated, contains engineering data. Copy sent upon request.



Full-bucket control automatic loader

Fine Reduction Crushers

In addition to the varied equipment for sand and gravel, crushed stone and other non-metallic mineral plants, the Diamond Iron Works, Minneapolis, Minn., designs and manufactures complete portable crushing and screening plants. These plants are made in different sizes to suit the client and so constructed that any part of the unit is readily renewable. It is claimed that, because these units are made of the best material and electrically welded, they have an exceptionally long life expectancy. These plants and their various component parts are intended to make aggregate to suit the most exacting specifications of construction engineers.

Trade Standards Issued

The Fourth Edition of the Trade Standards of The Compressed Air Society has just been published, and copies may be had upon application to C. H. Rohrbach, Secretary, 90 West Street, New York. Price, fifty cents each.

New material in the pamphlet comprises a new formula for use in air compressor testing, this being accurate for higher water columns than that previously used, thereby extending the capacity of a nozzle of a given size through a greater useful range; further suggestions in connection with the installation and operation of air compressors; caution against the use of old boilers or tanks as air receivers; suggestion for handling very cold "cooling water" so as to prevent condensation and undue wear on the air cylinders; and another illustration of an air cleaning device.

New York Gypsum Production

New York, which has extensive deposits in the district between Buffalo and Rochester, is the largest producer of gypsum in the United States, according to Information Circular 6163 of the Bureau of Mines. It is of interest also that New York was one of the first States to use gypsum in substantial quantities. At an early date it was importing thousands of tons annually for use as fertilizer. There is no record of the first gypsum produced in the State for use as fertilizer, but in 1835 production for use as a plaster was first recorded; from this small beginning the industry gradually developed in every gypsum locality where the population was sufficiently dense to offer a market for gypsum plasters.

The history of the gypsum industry in New York is replete with failures. Plants erected at the most likely deposits began operations only to find that there was no market, or if so, that competition was too keen, and they were compelled to close down. The Bureau of Mines has on file a list of 55 such companies, the majority of which never went into operation. As the industry grew, the New York mines suffered from the competition of Canadian gypsum due to their great distance from the more important consuming centers and to transportation difficulties which favored the importation of gypsum from Nova Scotia. With the exception of a small (but rapidly growing) consumption in New England, Pennsylvania, and New Jersey, the crude gypsum imported from Canada is consumed in New York and the majority of it is shipped direct to New York City for manufacture.

The production of gypsum in New York reached 1,730,254 short tons in 1925, the highest ever recorded. This compares very favorably with only 32,903 tons in 1890, or less than half of that produced in Michigan during the same year. The production of gypsum grew quite slowly during the last decade of the nineteenth century due not only to the importation of Canadian rock but to the decline in the use of gypsum as fertilizer. There were at least two reasons for the decline in the use of gypsum as land plaster; the first was the rapid growth in the demand for calcined plasters which absorbed the attention of the gypsum producers so that they made no effort to increase their sales to farmers, and the second was the active introduction of potash, nitrate, and phosphate fertilizers as the merits of these new materials became better known. Moreover, on land where it had been used continuously for years, land plaster failed in time to yield the same excellent results obtained from the first few applications, whereas the new fertilizers proved very helpful.

The use of calcined gypsum, on the other hand, made rapid and permanent progress in New York as elsewhere, and as the process of calcining was improved, the proportion of gypsum used for calcining far outstripped that for other purposes.

Despite all handicaps the sales of gypsum in New York, both crude and calcined, have shown a steady increase. The falling off of sales of gypsum as fertilizer has been more than offset by its use as a retarder in Portland cement. In 1925 the sales of crude or uncalcined gypsum produced in New York amounted to 354,394 tons, or 35 per cent of the total sales of crude in the United States, and 1,193,520 tons of calcined gypsum, or 29 per cent of the total sales. This was the record year in the gypsum industry in the United States. In addition, substantial quantities of imported gypsum were sold in the State.